7313 R-020-204.23

REMOVAL ACTION NO. 9, CHEMICAL TREATMENT PROJECT, FEMP MIED WASTE CHEMICAL TREATMENT PROJECT GENERAL CERCLA WORK PLAN

11/22/95

DOE-0162-96
DOE-FN EPAS
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WORK PLAN

7313

Department of Energy
Fernald Environmental Management Project
P. O. Box 398705
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NOV 2 2 1995

DOE-0162-96

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V-5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Thomas J. Schneider, Project Manager
Ohio Environmental Protection Agency
401 East Fifth Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

REMOVAL ACTION NO. 9, CHEMICAL TREATMENT PROJECT

The purpose of this letter is to transmit for approval, the Department of Energy (DOE) Fernald Environmental Management Project (FEMP) Mixed Waste Chemical Treatment Project General Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Work Plan. The project will be implemented under the scope of CERCLA Removal Action No. 9, removal of waste inventories, and the Director's Final Findings and Orders (DF&O), dated October 4, 1995. The DF&O approved the FEMP Site Treatment Plan (STP) as developed to comply with the Federal Facility Compliance Act (FFCAct). Under the approved STP, the DOE committed to submit a work plan to the U.S. Environmental Protection Agency (U.S. EPA) for the Chemical Treatment Project by November 30, 1995.

If you have any questions, please contact John Sattler at (513) 648-3145.

Sincerely,

Jack R. Craig
Director

Enclosure: As Stated

Recycled and Recyclable

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

MIXED WASTE CHEMICAL TREATMENT PROJECT

GENERAL CERCLA WORK PLAN

DOCUMENT #8ADD9-2200-002

Rev. 0

November 1995

Prepared by
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
P.O. BOX 538704
CINCINNATI, OHIO 45253-8704

Prepared for
U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE
Contract DE-AC24-92OR21972

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

MIXED WASTE CHEMICAL TREATMENT PROJECT

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MIXED WASTE CHEMICAL TREATMENT PROJECT
OHIO EPA RCRA PART B PERMIT
SUBSTANTIVE COMPLIANCE DEMONSTRATION

ITEM	CROSS REFERENCE INDEX
Interim Status: Treatment, Storage, and Disposal Facility General Facility Standards (OAC 3745-65-13 through 16) (40 CFR 265.13 through 265.16)	Section 2.0, 4.1.1, & 4.8.1
Hazardous Waste Determinations (OAC 3745-52-11) & (40 CFR 262.11)	Section 2.0 & 9.0
Container Storage (OAC 3745-52-34, 3745-66-70 through 77) (40 CFR 265.34, 265.170 through 265.177)	Section 4.1.1, 4.7, & 4.8
Land Disposal Restrictions (LDR) (OAC 3745-59) (40 CFR 268)	Section 4.4
Interim Status: Treatment, Storage, and Disposal Facility Preparedness and Prevention (OAC 3745-65-31 through 35, 3745-65-37) (40 CFR 265.31 through 265.35, 265.37)	Section 4.7
Residue of Hazardous Waste in Empty Containers (OAC 3745-51-07) (40 CFR 261.7)	Section 4.7
Interim Status: Treatment, Storage, and Disposal Facility Contingency Plan and Emergency Procedure (OAC 3745-65-51 through 56) (40 CFR 265.51 through 265.56)	Section 4.7
Reusable Equipment Decontamination (OEPA Closure Plan Review Guidance for RCRA Facilities)	Section 4.10

NOTE: Compliance with the applicable or relevant and appropriate requirements (ARARs) is discussed in Section 6.0 and in Table 6-1 of the attached General CERCLA Work Plan.

FEMP MIXED WASTE CHEMICAL TREATMENT
PROJECT GENERAL CERCLA WORK PLAN

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LIST OF ACRONYMS

ACA	Amended Consent Agreement
AEDO	Assistant Emergency Duty Officer
ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
ARC	Anti-Radioactivity Cleaning Compound
ASL	Analytical Support Level
ASTM	American Society of Testing and Materials
BAT	Best Available Technology
BDAT	Best Demonstrated Available Technology
CAA	*Clean Air Act*
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	Code of Federal Regulations
CWA	*Clean Water Act*
DOE-FN	U. S. Department of Energy, Fernald Field Office
DOT	U. S. Department of Transportation
DQO	Data Quality Objectives
EDL	Economic Discard Limit
EPA	Environmental Protection Agency
EPCRA	*Emergency Planning and Community Right-to-Know Act*
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFCAct	*Federal Facility Compliance Act*
HC	Hazard Category
HEPA	High Efficiency Particulate Air
IDLH	Immediately Dangerous to Life or Health
LDR	Land Disposal Restrictions
LLRW	Low Level Radioactive Waste
MDO	Materials Disposition Order
MEF	Material Evaluation Form
MSDS	Material Safety Data Sheet
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEMA	National Electrical Manufacturer's Association
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFS	Nuclear Fuel Services, Inc.
NORM	Naturally Occurring Radioactive Materials
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORR	Operational Readiness Review
OSHA	Occupational Safety and Health Administration
PAT	Process Acceptance Test
PCB	Polychlorinated Biphenyls
PFLT	Paint Filter Liquids Test

LIST OF ACRONYMS (Cont.)

PHA	Preliminary Hazard Analysis
PSHSP	Project Specific Health & Safety Plan
PWBS	Project Work Breakdown Structure
QA	Quality Assurance
RA	Removal Action
RAM	Radioactive Materials
RCRA	*Resource Conservation and Recovery Act*
RTR	Real Time Radiography
SA	Safety Assessment
SAP	Sampling and Analysis Plan
SCQ	Site-Wide CERCLA Quality Assurance Project Plan
SIC	Standard Industrial Codes
STP	Site Treatment Plan
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TLD	Thermo Luminescent Dosimeter
TOC	Total Organic Compounds
TSCA	*Toxic Substance Control Act*
TSDF	Treatment, Storage, and Disposal Facility
WAC	Waste Acceptance Criteria
WAP	Waste Acceptance Plan
WWTF	Waste Water Treatment Facility

FERNALD MIXED WASTE CHEMICAL TREATMENT PROJECT

1.0 INTRODUCTION

This work plan describes the objectives and general scope of work for the Mixed Waste Chemical Treatment Project to be conducted at the U. S. Department of Energy's Fernald Site (DOE-FN). The Fernald Site is a government owned, former uranium processing facility located near Cincinnati, Ohio. The site was placed on the National Priorities List in 1989 and is currently undergoing remediation under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) in accordance with the 1991 *Amended Consent Agreement* (ACA) between the DOE and the U. S. Environmental Protection Agency (EPA).

The ACA requires DOE-FN to submit an annual compendium of existing procedures and documentation for the site's Low-Level Radioactive Waste (LLRW) Management Program, in lieu of Removal Action Work Plans. Additionally, DOE-FN committed to submitting project work plans for certain projects, including Mixed Waste Chemical Treatment, in Addendum No. 1 to the Removal Action (RA) 9 - Removal of Waste Inventories Work Plan. Submittal of this plan is intended to satisfy ACA and RA9 driven requirements by incorporating documentation and management of the project under RA9.

The Chemical Treatment Project is the implementation of the Ohio Mobile Chemical Treatment System preferred option presented in the FEMP Site Treatment Plan (STP). The U.S. Department of Energy (DOE) was required to prepare Site Treatment Plans describing the development of treatment capacities and technologies for treating mixed waste under Section 3021(b) of the *Resource Conservation and Recovery Act* (RCRA), as amended by the *Federal Facility Compliance Act* (FFCAct). Mixed waste is defined by the FFCAct as waste containing both hazardous waste subject to RCRA and source, special nuclear, or by-product material subject to the *Atomic Energy Act* of 1954 (42 U.S.C. 2011). The STP was approved and a Director's Final Findings and Orders issued October 1995.

As described in the STP, treatment of the waste in the Chemical Treatment Project will occur on-site using currently available technologies and vendor provided mobile services augmented by existing on-site facilities. The use of mobile treatment processes provides an equitable solution between Ohio and other states when comparing this option with out-of-state treatment options and does not require permitting. Chemical treatment processes performed at ambient temperatures are preferred to incineration technologies. This is due to anticipated negative public reaction and unavailability of incineration facilities which accept radioactive solids. If ambient temperature treatment is not feasible, alternative technologies using elevated temperatures, (i.e., drying and thermal desorption), will be investigated.

RCRA Land Disposal Restrictions (LDR) for waste in the Chemical Treatment Project include technology and concentration based standards promulgated in 40 Code of Federal Regulations (CFR) 268 . Treatment will consist of a series of components and technologies. Treatment technologies will include, to the extent practicable, systems to recycle water or reagents used in treatment processes thereby minimizing the quantity of secondary waste generated during treatment operations. The following are the primary treatment technologies to be implemented in the Chemical Treatment Project:

- Amalgamation - used to immobilize elemental mercury in a variety of waste matrices.
- Chemical Extraction - used to extract organic contaminants from wastes, such as debris, sludges, and liquids into a liquid matrix.
- Chemical Oxidation - used to destroy organic constituents.
- Deactivation - used to treat reactive, ignitable, and corrosive characteristics of waste, thereby removing that characteristic.
- Decontamination - used to remove surface contamination from debris, lead solids, and batteries.
- Macroencapsulation - utilized as a means of immobilization, primarily of lead solids, batteries, and debris.
- Neutralization - used to adjust pH of acidic and caustic waste(s).
- Precipitation - chemical stabilization of metal laden waste.
- Uranium Recovery - used to purify a specific inventory of uranium residues to create nuclear grade uranium for resale.

Detailed explanations of implementation for each of the listed treatment technologies is provided in Section 4.0 of this Work Plan.

The total chemical treatment may involve waste processing technologies in addition to listed primary chemical treatment technologies. For example, waste segregation will be implemented as a preliminary treatment. The purpose of segregation is to physically separate unlike materials into proper waste categories for processing through one of the specified treatment processes. Many of the waste categories require combining treatment technologies to effectively remove all contaminants. As stated in the STP, these combined technologies are referred to as a Treatment Train. Chemical treatment processes, employing one of the listed technologies, comprise a single unit in a Treatment Train. A Treatment Train or combination of technologies may be specified as a single treatment standard per 40 CFR 268.42. Treatment will commence with waste segregation and end when the waste meets LDR standards and disposal facility Waste Acceptance Criteria (WAC) qualifying the wastes for final disposition.

As a result of the Chemical Treatment operations, secondary wastes will be generated. Secondary wastes are wastes generated as a result of treatment of the primary waste. These include: waste waters, spent extraction solvents and decontamination solutions, treated solids, and personal protective equipment (PPE). Secondary waste will be managed through a process similar to the established Mixed Waste Stabilization Project, bulked for disposition through the FEMP Waste Water Treatment Facility (WWTF) or the Toxic Substance Control Act (TSCA) Incinerator in Oak Ridge, TN, or shipped for disposal at a mixed waste permitted facility or the Nevada Test Site (NTS).

1.1 OBJECTIVES

The objective of the Mixed Waste Chemical Treatment Project is to safely treat listed and characteristic mixed LLRW currently being stored at the FEMP Site. These wastes have been characterized as containing hazardous constituents regulated under RCRA and include EPA waste codes D001 - D043, F001- F005, and several U codes. The wastes will be treated to meet RCRA LDR standards and disposal facility WAC. Currently, no off-site permitted facility exists to accept mixed waste in the chemical treatment project inventory. However, if an off-site option becomes available, it will be evaluated and given full consideration. Existing outlets for treated primary and secondary waste include: Envirocare, NTS, FEMP WWTF and the TSCA Incinerator. Additional disposal options will be researched and evaluated as they become available.

Due to the variety of mixed waste in the Chemical Treatment Project, multiple treatment processes will be required to meet LDR standards. Waste streams in the Chemical Treatment Project have been divided into eleven categories. Each waste category represents waste streams which may be treated by a treatment process described in this Work Plan.

Treatment process descriptions are provided for technologies which have demonstrated through treatability studies and research to have the most promise for successful treatment of a particular waste category. These treatment processes are conceptual and are subject to change. The process descriptions do not necessarily represent the selected treatment process. Research will continue and as new treatment alternatives are identified, they will be evaluated and given full consideration.

This work plan is intended to be a general discussion of the scope of the Chemical Treatment Project and will provide an overview of waste categories and conceptual treatment processes. It is submitted to comply with the STP pursuant to the FFCAct driven requirements by incorporating documentation and management of the project under RA9. Detailed descriptions of specific treatment processes will not be provided in this General Work Plan. The details will be provided in technology specific work plans developed by the vendor/contractor(s) chosen to conduct treatment in conjunction with FEMP personnel. The Waste Segregation process will be performed utilizing FEMP personnel only. The Technology Specific Work Plan for Waste Segregation will be prepared by FEMP personnel. Development of the Technology Specific Work Plans is driven by commitments made by the FEMP in the STP.

Except for waste segregation, treatment processing will be performed by vendor/contractor(s) working in conjunction with FEMP personnel. The Technology Specific Work Plan for each treatment process will include a Process Control Plan, Sampling and Analysis Plans, Quality Assurance Plan, and Health and Safety Plan specific to the treatment process as required. In combination, the Technology Specific Work Plans will demonstrate that the treatment process will be accomplished in compliance with applicable federal, state, and local regulatory requirements, DOE Orders, and site procedures.

1.2 ORGANIZATION OF THIS WORK PLAN

This General Work Plan is organized in the manner that is consistent with previously submitted and approved Work Plans. This Work Plan provides a general description of how and where the Chemical Treatment Project will be performed. The plan identifies requirements to be addressed for storage, handling, treatment, shipment and disposal, quality assurance, environmental compliance, and health and safety. Section 2.0 of the Work Plan provides a description of waste categories requiring treatment and the Material Evaluation Form (MEF) waste characterization process performed for each waste stream. Section 3.0 describes bench-scale treatability and optimization tests aimed at developing and successfully applying chemical treatment processes for each waste category. Treatability tests are currently being performed by Nuclear Fuel Services, Inc. Section 4.0 provides a general description of the chemical treatment processes which currently demonstrate the most promise to successfully treat each waste category. This process description is presented in terms of the major treatment processes with corresponding Process Flow Diagrams. Section 5.0 describes options and plans for disposition of treated primary and secondary waste(s). Section 6.0 describes the applicable or relevant and appropriate requirements (ARARs) for this project. Section 7.0 describes the health and safety program to be implemented during this project. Section 8.0 outlines the organization of the project team, and how the work and the project schedule will be managed. Section 9.0 provides sampling and analysis requirements for each treatment process. Section 10.0 identifies references used in developing this Work Plan.

2.0 WASTE CATEGORY DESCRIPTIONS

Since October 1991, RCRA closure actions and CERCLA response actions have redirected the central mission of the FEMP towards the implementation of waste management and environmental restoration initiatives. One of these initiatives is to identify, characterize, treat, and disposition all legacy waste stored at the FEMP site in accordance with applicable federal, state, and local requirements. Containers of mixed waste identified for treatment in the Chemical Treatment Project are stored in RCRA-permitted storage areas at the FEMP site.

Containers of mixed waste have been grouped and characterized using MEF procedures discussed in this section. MEFs represent waste streams which were then placed into waste categories based on waste matrix, characteristics, and constituents. Each waste category represents a grouping amenable to one of the treatment processes discussed in Section 4.0. The categories include solids, sludges, and liquid material contaminated with uranium, thorium, inorganic toxicity characteristic (TC) metals with EPA waste codes D004-D011, and organics such as polychlorinated biphenyls (PCBs), pesticides, halogenated and non-halogenated volatiles, semi-volatiles, ignitable, corrosive, and reactive waste(s). Real Time Radiography (RTR) which uses x-ray technology to view the contents of a container, visual inspections, and process knowledge were used to categorize the waste streams. General waste categories are provided below:

1. Debris
2. Fines, Sludges, and Soils
3. Mercury Waste
4. Lead Solids
5. Ni-Cd Batteries
6. Reactives
7. Oxidizers
8. Barium Chloride Salts
9. PCBs
10. Corrosives
11. Uranium Residues

A short description of each waste category to be treated by the Chemical Treatment Project is given below.

Debris - This includes waste which meets the regulatory definition of debris promulgated in 40 CFR 268.2 (9) (i.e., a solid exceeding a particle size of 60mm [2.5"] in any dimension). This includes rags, absorbent pads, paper, PPE, wood, metal, plastic, etc. Primary contaminants are listed and characteristic organic solvents (halogenated and non-halogenated) and waste oils. Some wastes contain TC metals (EPA waste codes D004 through D011). All have low concentrations of uranium contamination. The debris may be commingled with other materials which do not meet the definition of debris. These materials include sludges, soils, fines, and liquids.

Fines, Sludges, and Soils - This category includes dry granular solids, wet and dry sludges, oily sludges, soils, sump cakes, and other like materials. Primary contaminants are listed and characteristic organic solvents (halogenated and non-halogenated). Organic concentrations range widely from very low concentrations up to 200,000 ppm. Some wastes contain TC metals. Uranium concentrations vary widely.

Lead Solids - This category includes solid lead material such as lead bricks, shielding, wire, and tools with uranium surface contamination.

Ni-Cd Batteries - Rechargeable batteries containing cadmium with uranium surface contamination.

Reactives - Fine metals exhibiting the characteristics of ignitability or reactivity with water. These include granular magnesium metal and calcium metal.

Oxidizers - Include oxidizers as defined under 49 CFR 173.127. Primarily, this category includes uranium nitrate, thorium nitrate, sodium nitrate, and potassium nitrate. This category is comprised of solids and liquids.

Barium Chloride Salts - Include furnace salts, contaminated brick and floor sweepings. Primary contaminants are TC metals, barium, and lead. Wastes contain barium concentrations as high as 10,000 ppm. Barium chloride is very soluble in water.

Polychlorinated Biphenyls (PCBs) - Include PCB contaminated light ballasts, soils, sludges, scabbled concrete, and debris. These contain hazardous and nonhazardous constituents. PCB concentrations vary from 50 - 150 ppm.

Corrosives - Include caustic and acidic aqueous solutions with pH greater than or equal to 12.5 or less than or equal to 2.0. These wastes also contain organic solvents (halogenated and non-halogenated) and inorganic hazardous constituents.

Mercury Waste - This category includes elemental mercury, various elemental mercury contaminated matrices including debris and water, mercury contaminated salts, mercury batteries, and crushed fluorescent light tubes. Some wastes also contain cadmium, lead, and chromium. Uranium concentrations vary.

Uranium Residues - Process residues with uranium concentrations above the Economic Discard Limit (EDL), (i.e., uranium is in sufficient concentration to make recovery economical). The material primarily includes uranium oxides contaminated with TC metals. Some uranium residues are derived from the oxidation of F-listed solvents. These currently meet LDRs, but do not meet disposal facility WAC.

Mixed waste to be treated in this project has been characterized using process knowledge and sampling and analysis results in accordance with site procedure EW-0001, "Initializing Waste Characterization Activities Using the Material Evaluation Form," the Waste Characterization Manual, and the FEMP Waste Analysis Plan. The waste characterization methodologies specified by EW-0001 are consistent with USEPA and Ohio EPA hazardous waste regulations. Although the drums of mixed waste have been characterized under EW-0001, it is possible that some waste containers may contain waste materials or anomalies that differ from the MEF characterization. During waste segregation operations, these anomalies will be identified and transferred to the appropriate treatment process or set aside and evaluated for proper disposition. RTR results will be employed to aid in screening containers to identify these materials.

The primary document for completing waste characterization is the three page MEF which is part of EW-0001. The first page of the MEF is the Generator's Section which summarizes information provided by the FEMP (internal) waste generator. This section is similar to the waste profile sheets used by commercial treatment, storage, and disposal facilities (TSDFs) allowing for documentation of information regarding: generator and waste stream identification; generation information; gross material characteristics; material composition; and health and safety precautions.

The second and third pages of the MEF are the Evaluation Section which summarizes the results of the waste characterization with respect to evaluation criteria, and pertinent information from the evaluation process including: material regulatory status; material management requirements; and health and safety precautions.

The MEF evaluation process relies on a combination of process knowledge and sampling and analysis to complete the waste characterization. Process knowledge includes the sum of all information that can be collected on a material, including information from operating procedures, manufacturing specifications, material safety data sheets (MSDS), spill reporting logs, visual inspections, and personnel interviews. All process knowledge contributing to waste characterization is documented in the waste characterization files.

Sampling and analysis conducted in support of the MEF process is conducted in accordance with USEPA SW-846, *Test Methods for Evaluating Solid Waste.* Protocols required by other regulatory programs are used when applicable. All data required to support waste characterization by sampling and analysis are included in the MEF waste characterization files. This includes the request for analysis, sampling plan, field sample log book, analytical data report, QA/QC report, chain-of-custody forms, and statistical treatment of analytical data once the sampling and analysis is completed.

3.0 TREATABILITY STUDIES

Treatability studies are currently being performed by Nuclear Fuel Services, Inc., (NFS) to evaluate the capability of various technologies to treat FEMP mixed waste. There are two treatability studies being performed. One is for mercury waste, and the other includes multiple waste categories from the Mixed Waste Chemical Treatment Project. The goal of the treatability studies is to identify which available treatment technologies, when applied to the FEMP mixed waste streams, will result in waste(s) which meet LDRs. Waste meeting LDRs qualifies for land disposal as LLRW or mixed waste at a permitted TSDF. Studies include investigation of decontamination procedures for free release to a recycling facility. A secondary objective is to develop treatment methods applicable to more than one waste stream to minimize equipment, labor, and cost of full-scale treatment.

3.1 CHEMICAL TREATMENT TREATABILITY STUDY

Currently, there are 11 general waste categories in the Chemical Treatment Project. NFS is performing treatability studies on thirteen waste streams from seven of the general waste categories in this study. Table 3-1 shows the waste streams on which treatability tests were performed with corresponding EPA hazardous waste codes and waste categories. Each waste category may be represented by more than one waste stream with varying waste codes between waste streams.

TABLE 3-1
CHEMICAL TREATMENT TREATABILITY STUDY

Waste Stream	EPA Waste Codes	Waste Category
Rags, Paper, Plastic	D005, F001	Debris
Trash-Absorbent pads, mops, plastic	F002	Debris
Solvent and contaminated Filter Material	D039, F002	Fines, Sludges, and Soils
Sump Cake and Debris	D039	Fines, Sludges, and Soils
Oily Sludges	D001,D019,D039,D040, F001,F003,F005	Fines, Sludges, and Soils
Contaminated Soil	F001, F002	Fines, Sludges, and Soils
Lead Solids	D008	Lead Solids
Magnesium Shavings	D001	Reactives
Floor Sweepings-Chunks of graphite, graphite dust	D005, D008	Barium Chloride Salts
Furnace Bricks-Chunks of furnace salt	D005	Barium Chloride Salts
Caustic Laboratory Waste	D001,D002,D006,D008, D009,D018,D035	Corrosives
Acid Digestate-Liquid	D002,D007,D008,D019, D028,D039,F001,F002	Corrosives
Uranium Oxide	F002	Uranium Residues

Treatability tests were not performed on oxidizers, PCBs, and Ni-Cd batteries. Enough information is currently available to effectively treat oxidizers. Mercury waste is included in a separate study discussed in Section 3.2. Test results from decontamination of mercury batteries in the mercury treatment treatability study and lead solids will be applied to treatment of Ni-Cd batteries. The treatment standard for PCBs is incineration, however, alternative technologies are being researched. Currently, the FEMP does not have an approved alternative treatment technology for PCBs. If further research identifies a viable treatment alternative, treatability studies for PCBs may be performed.

The following sections provide a brief description for each waste stream investigated in the Chemical Treatment Treatability Study. These streams were selected to represent the most challenging waste in each category. The studies are still in progress. The descriptions provide the most up-to-date information available and when applicable, describe future studies which may be performed for each category.

3.1.1 Rags, Plastic, Paper

The debris was cleaned by solvent extraction in a unit resembling a small laundry washer. The extraction solution was a mixture of water with an industrial detergent and aluminum sulfate. The washing was successful, however, the rags were not easily determined clean via visual inspection. Sampling and analysis results showed that no hazardous constituents were detected above regulatory levels.

3.1.2 Trash, Absorbent Pads, Mops, Plastic

The debris was cleaned by solvent extraction in a unit resembling a small laundry washer. The extraction solution was a mixture of water with an industrial detergent (i.e., Triton X-100 and/or Tide). The washing was successful, however, the rags were not easily determined clean via visual inspection. Sampling and analysis results showed that no hazardous constituents were detected above regulatory levels. Treatment of the wash water included a pH adjustment to break the emulsion followed by steam stripping. Additional testing may be performed to determine the best methods for treating the wash waters and to optimize and provide proof of process for the laundering operations.

3.1.3 Solvent Contaminated Filter Material

The solvent contaminated filter material contains high and low boiling volatile organic compounds. The low boiling volatiles were easily removed with steam stripping and water slurried distillation. However, the steam stripping and distillation were not successful for the high boilers. Solvent extraction using aqueous based solvent was not successful due to poor filtration. Additional treatment testing may be performed using low temperature drying and organic solvent (i.e., isobutyl alcohol, acetone) extraction methods.

3.1.4 Sump Cake and Debris

Pretreatment sampling results showed no solvents in the waste stream. Therefore, no results are reported for this waste stream.

3.1.5 Oily Sludges

Treatability tests for oily sludges have not produced an optimized treatment process as yet. Results of distillation tests on oily sludges indicate that treatment by distillation or steam stripping will not be appropriate due to the presence of high boilers. Further research for an appropriate treatment technology may be performed. Additional testing may include the use of non-halogenated organic solvents such as acetone or alcohols and drying and condensing.

3.1.6 Contaminated Soil

Washing contaminated soil with aqueous solutions of detergents and surfactants did not produce satisfactory results. Filtration of the aqueous solutions was very slow and would not be applicable for large scale use. Other treatments may be investigated which include using organic solvents such as acetone or alcohols to extract contaminants, and drying and condensing.

3.1.7 Lead Solids

The goal of this treatability study is to decontaminate radioactive contaminated lead solids to meet free-release criteria. The resulting clean lead would be eligible for shipment to a permitted recycle facility. The treatability tests showed decontamination can be accomplished using a cleaning agent called Anti-Radioactivity Cleaning (ARC) compound. Treatment of the decontamination solution was accomplished by filtering, then neutralization and precipitation of lead with sodium sulfide.

3.1.8 Magnesium Shavings

Magnesium shavings with the EPA waste code of ignitability (D001) were coated using 30 weight motor oil and then mixed with Petroset II for deactivation. After Petroset II was thoroughly incorporated into the mixture, methanol was added to stiffen the mixture. The mixture produced a stabilized semi-solid which passed a paint filter liquids test (PFLT) and would no longer exhibit the characteristic of ignitability.

3.1.9 Floor Sweepings-Chunks of Graphite, Graphite Dust

The waste was successfully treated by dissolving with water and precipitation with aluminum sulfate to form a slurry. This process may also be combined with stabilization/solidification with Portland cement. The resulting waste stream is nonhazardous.

3.1.10 Furnace Bricks-Chunks of Furnace Salt

The furnace brick and furnace salt waste stream was easily broken into small pieces with a hammer and placed in water. The pieces were nearly 100% soluble when placed in water indicating the waste was a hardened mass of barium chloride salt. The barium chloride solution went through a precipitation phase using a flocculent and aluminum sulfate. The resulting waste streams were non-leachable barium sulfate and salt water. Following the dissolution/precipitation process, the barium sulfate was analyzed and passed toxicity characteristic leaching procedure (TCLP) for barium and other heavy metals. This process may be combined with stabilization/solidification with Portland cement.

3.1.11 Caustic Laboratory Waste/Acid Digestate-Liquid

Caustic and acidic wastes were combined to neutralize each other. The resultant wastes were then treated for organic solvents and inorganic contaminants. The solvents were treated via steam stripping, the inorganic contaminants were treated through precipitation. The resulting stream was hazardous for mercury. This was probably due to the high pH conditions during treatment of the waste. The mercury contaminant was never dissolved into solution and therefore, could not be precipitated properly. This can be resolved by acidifying the waste to a pH of 2.0 to 3.0 to destroy the mercury hydroxides. Then, adjust the pH to approximately 9.0 and add sodium sulfide. After the sulfide addition, the waste can be steam stripped to remove the organics and filtered.

3.1.12 Cobalt Trifluoride

The cobalt trifluoride was reacted with water in a controlled manner, preventing emission of HF gas to the environment. The resulting water solution contained HF and was neutralized with lime.

3.1.13 Uranium Oxide

Purification of uranium oxide was achieved by precipitation with peroxide and by solvent extraction followed by precipitation with peroxide. The solvent used was tributylphosphate (TBP) in normal paraffin hydrocarbon (NPH). Results indicated that hydrogen peroxide precipitation is adequate to meet purification standards documented in American Society of Testing and Materials (ASTM) C 788-93 for nuclear-grade uranyl nitrate solution. Studies indicate that the peroxide precipitation met the standards and solvent extraction would not be required.

3.2 MERCURY TREATMENT TREATABILITY STUDY

The Mercury Treatment Treatability Study is on-going. The FEMP has approximately 36 drums of mercury and uranium contaminated mixed waste. Some of these wastes also contain the toxicity characteristic metals barium (D005), cadmium (D006), chromium (D007), and lead (D008). Waste types include spent elemental mercury, mercury contaminated salts, mercury batteries, fluorescent light bulbs, mercury contaminated water, and debris contaminated with elemental mercury. Treatment methods developed as a result of this treatability study will be used to support DOE Complex needs for similar mercury contaminated waste streams. Existing inventory of FEMP mercury contaminated waste will be consumed by this treatability study. Results from this study will also be used for treatment and disposal of mercury wastes generated as a result of future FEMP remediation efforts.

3.2.1 Elemental Mercury

According to 40 CFR 268.40, elemental mercury contaminated with radioactive materials must use amalgamation for treatment utilizing inorganic reagents such as copper, zinc, gold, and sulfur. Optimization tests will be conducted to determine the best method of amalgamation and the optimum conditions for treatment of this waste stream.

3.2.2 Mercury Contaminated Bulbs/Lamps/Glass

Mercury contaminated waste consists of debris and non-debris size items including bulbs, lamps, and laboratory glassware. Studies may include water wash using detergents, surfactants, acids, or bases or a modified amalgamation process.

3.2.3 Mercury Contaminated Uranium Salts and Residues

Based on information in waste characterization documents, the uranium salts and residues contaminated with mercury will be treated using amalgamation. This treatment process will treat the mercury followed by sulfide precipitation to treat any remaining heavy metals. Bench-scale tests will be conducted to determine optimum conditions for performing treatment.

3.2.4 Mercury Containing Dry Cell Batteries

Since mercury based dry cell batteries are sealed units, any radioactive contamination will be located on the exterior surface of the battery case(s). The ARC cleaner, used for lead solids decontamination in the Chemical Treatment Project Treatability Study, will be used to decontaminate the exterior case of the battery to free release limits. This will allow the battery to be sent to a battery recycling center. Corroded batteries or batteries with breached casings, to the extent Radiological Compliance will not free-release them, will be reclassified and placed into the macroencapsulation treatment category.

3.2.5 Mercury Contaminated Water

Mercury contaminated water, which also contains chromium and lead, will be treated using precipitation techniques. Mercury, chromium, and lead will be precipitated out of the water using sodium sulfide and a flocculating agent. Filter cake produced from the precipitation will contain metal sulfides and metal hydroxides that are extremely insoluble.

3.2.6 Mercury Contaminated Debris

Debris can be treated using chemical extraction (i.e., debris washing) as defined in Table 1 of 40 CFR 268.45 or a modified amalgamation process. Non-debris collected during segregation will be treated using an aqueous amalgamation process. This process will treat the elemental mercury followed by a precipitation step to treat any remaining heavy metals. The filter cake produced will contain a mercury amalgam and insoluble metal sulfides.

4.0 TREATMENT DESCRIPTION

This section provides the general description of conceptual treatment processes for identified waste categories and presents additional potential treatment options criteria for process control measures, waste management outlets and minimization opportunities, facility descriptions, project schedule, and decontamination/demobilization activities.

4.1 TREATMENT CATEGORIES

All waste in the Chemical Treatment Project inventory has been placed into general waste categories. Descriptions of these categories are provided in Section 2.0 of this document. These categories are based on the waste matrix, characteristics, and constituents to be treated. Treatment processes to be used will treat one or more categories. The following table provides the relationship of the waste categories and conceptual treatment processes.

TABLE 4-1

WASTE CATEGORY	TREATMENT PROCESS
Below EDL Waste†	Waste Segregation
Fines, Sludges, and Soils	Chemical Oxidation/Extraction
Lead Solids	Decontamination*
Debris	Debris Washing
Ni-Cd batteries	
Reactives	Deactivation
Oxidizers	
Barium Chloride Salts	Precipitation/Neutralization
Corrosives	
PCBs	PCB Chemical
Mercury Waste	Amalgamation
Uranium Residues	Uranium Recovery

† Includes all waste categories except uranium residues.

* If Debris Washing or Decontamination does not meet LDR or performance standards, macroencapsulation will be implemented. Macroencapsulation for debris may be utilized in lieu of Debris Washing if it is deemed more feasible.

The flow of waste through each process will be controlled and tracked to assure proper treatment and performance of final testing. Control of waste entering a treatment process is required to exclude incompatible wastes. Control also assures the treatment process compensates for waste stream variances within treatment categories. Available information regarding the waste streams will be reviewed including RTRs, visual inspections, process knowledge, analytical data, and hazardous constituents to assure only compatible wastes are processed. The first treatment process, Waste Segregation, will resolve the majority of these situations. Tracking of each waste stream entering a treatment process to the treated and secondary waste generated is required for characterization purposes. Wastes from several MEFs may be consolidated prior to treatment processing to increase process efficiency. Only wastes comprised of similar contaminants and matrices and requiring similar treatment will be consolidated. The final treated waste will be managed under one or several new MEFs dependent on contaminants and final disposition.

4.1.1 Management of Mixed Wastes in Containers

The Chemical Treatment Project involves container management at most stages of the process. Mixed waste at the FEMP site is packaged in containers of various sizes, ranging from 5-gallon pails up to 100 cubic feet white metal boxes. In some cases, containers are repetitively overpacked into larger containers to control leaks. The containerized wastes are characterized and classified in waste streams which are documented in individually numbered MEFs. The containers are packaged, labeled, marked, and managed in accordance with RCRA requirements in permitted storage facilities on the FEMP site.

Prior to final disposition, treated waste will be collected and managed in new or re-used containers meeting U.S. Department of Transportation (DOT) requirements. Any temporary storage will be compliant with RCRA requirements. Containers will be filled to maximum volume or weight capacity to minimize freeboard or empty headspace. The actual container used will depend on the disposal facility WAC. Each container will be labeled and marked in accordance with DOT, and when applicable, RCRA requirements. Operating records will preserve the original container identities for tracking purposes.

Waste which has undergone partial treatment, but requires interim storage for more than 90 days prior to further treatment, will be packaged and returned to RCRA storage areas and managed as mixed waste. This includes waste processed through waste segregation.

4.2 ADDITIONAL TESTING AND DESIGN DEVELOPMENT

As described in Section 3.0 of this work plan, treatability studies and optimization testing are being performed for waste categories in the Chemical Treatment Project. Additional optimization and proof of process studies may be performed for each selected treatment process to ensure that the treatment process is effective, to optimize the process for waste minimization, and to manage varying concentration levels and constituents of input waste streams. The tests will provide useful information in the development of the selected treatment process.

Section 3.0 of this Work Plan describes the Chemical Treatment treatability studies conducted to date. These tests were performed primarily for the purposes of evaluating a variety of potential treatment processes. Small samples were selected to represent the most challenging waste streams from each waste category.

Additional bench-scale design recipe optimization tests may be performed for each waste category. This testing will be used to develop input parameter requirements for raw wastes, reagent concentration requirements, and performance specifications. Wastes not meeting these input requirements may require pretreatment or may be excluded from the treatment process and reassessed for alternative treatment processes. Performance specifications will be evaluated by the operator prior to removal of the treated waste from the process area. The results of the evaluation will determine if additional treatment is required prior to removal from the unit. If treatment consistently fails to meet performance specifications, the operator will notify the Treatment Process Supervisor, who may choose to perform additional testing for the purpose of adjusting the treatment design.

4.3 TREATMENT PROCESS DESCRIPTIONS

The following sections provide descriptions of the conceptual treatment processes and discusses potential treatment options for each waste category in the Chemical Treatment Project that will be used to meet LDR. General descriptions are provided for the treatment processes which show the most promise for successfully treating the waste. These processes were identified through research and supplemented with treatability studies and do not necessarily represent the selected treatment process. Research will continue and as new treatment alternatives are identified, they will be evaluated and given full consideration. Preference was given to those technologies which could be performed at ambient temperatures. If ambient temperature treatment is not feasible, treatment process using temperatures (i.e., drying and thermal desorption) will be investigated. Preference is also given to technologies which are mobile and can be brought to and removed from the site. Mobile treatment equipment eliminates the need to design and construct permanent on-site treatment units which may require additional approval and eventual facility decommissioning. Furthermore, the availability of permitted off-site mixed waste treatment facilities is limited. Treatability testing is currently underway and has provided important input in developing the conceptual treatment processes. As the studies progress, the processes will be further defined. Specifics for treatment processes for each treatment group will be provided in technology specific work plans developed by the vendor/contractor performing each treatment process.

4.3.1 Treatability Variances

There may be instances where it may not be possible to treat some waste streams to the levels or by the technologies specified by the land disposal restrictions. This is due to the complexity of the waste matrices, the presence of the radioactive contaminants or other circumstances. Examples of wastes which may require alternative treatment technologies are lead-acid and Ni-Cad batteries which cannot be decontaminated to free release criteria, Halogenated Organic Compound (HOC), and Polychlorinated Biphenyl (PCB) wastes which cannot be incinerated. In these cases, alternative treatment technologies will be utilized per 40 CFR 268.42(b) and 268.44 (see also Section 6.0, Table 6-1).

Instances where it is anticipated that alternative treatment technologies may be necessary have been noted in the technology descriptions in Section 4.0. Future selection of alternative treatment technologies will be identified in the technology specific work plans. Because of the FEMP site's CERCLA status, no separate variance request under RCRA will be made. This notification complies with the substantive RCRA requirements.

4.3.2 Waste Segregation

Waste segregation will be the first treatment process for the Chemical Treatment Project wastes. Waste segregation involves the selective splitting of heterogeneous waste streams into more homogeneous waste streams. As described in Section 2.0, the Chemical Treatment Project inventory has been placed in waste categories based on similar matrices, characteristics, and hazardous constituents. RTR results indicate some containers in the project contain waste which would qualify for two or more categories. To resolve these potential treatment problems, segregation is required to place the wastes into the proper waste categories. Selective sorting will allow waste to proceed efficiently in subsequent treatment processes. RTR results, visual inspections, and process knowledge will be employed to evaluate each waste stream in the Chemical Treatment Project to determine which containers require segregation. This will be performed as a screening measure to limit the number of containers which must be handled. Waste will not be processed if it is determined that segregation would not be beneficial. This determination will be primarily based on the homogeneity of the waste and the absence of anomalies.

Waste segregation operations will be performed by the on-site work force. Work plans, procedures, and start up documentation will be developed by FEMP personnel. Criteria will be developed as a guideline for the segregation process. The primary goal of this operation is to remove debris from non-debris waste categories and remove anomalies. The debris may be further segregated into sub-categories. These sub-categories may include soft solids and hard solids. These sub-categories will be determined based on the unique treatment needs of each sub-category.

Materials which do not match the established sub-categories will be set aside and evaluated to determine a proper waste category. If a proper category cannot be identified, new treatment processes will be investigated. Contents of the waste containers will also be evaluated to assure the waste in the containers matches characterization information in the MEF. Containers with contents not matching MEF information will be set aside and Waste Characterization will perform further evaluation. After evaluation, the waste may be returned to the same waste stream, placed in another existing waste stream, or undergo a complete characterization as a new waste stream.

Visual inspection and evaluation is the first stage of segregation and will determine whether segregation will be performed. Results from RTR will be reviewed prior to opening the container to support this determination. The lid of each selected container will be removed and the contents visually inspected and evaluated to determine whether debris, anomalies or unidentified hazards are present.

Following visual inspection, the debris and anomalies will be removed from the container. Removal may be aided by the use of a screening table. Non-debris and debris will be segregated, collected, and evaluated for consolidation into containers for each designated waste sub-category. Only waste with similar contaminants and matrices requiring similar treatment will be consolidated (i.e., solvent contaminated waste with other solvent contaminated waste). Debris which is inherently hazardous waste (i.e., lead solids, Ni-Cd batteries, or mercury batteries) will be removed, evaluated, and placed into the proper waste category for further treatment. Anomalies will be evaluated for placement in a proper waste category. If the anomaly does not fit a waste category, it will be set aside for further evaluation to identify a new treatment process.

Wastes consolidated from multiple MEFs will be tracked under a new MEF. A packing list will be kept for each drum to track the waste consolidated in each container. The list will include the original MEF number, the type of waste, and all the waste codes from the original characterization (except those which are matrix specific (i.e., ignitable liquids [D001], and corrosive [D002]). Full consolidation containers will be returned to storage to await treatment at a later date. Prior to storage, the drums will be properly labeled to comply with RCRA storage requirements and on-site waste tracking requirements. The waste characterization of these containers will be managed by tracking all appropriate waste codes into the new MEF. This tracking mechanism for in-process waste will obviate the need to perform extended waste characterization.

Waste segregation is the first step of the treatment train for the waste in the Chemical Treatment Project. After being processed through the segregation step, these wastes are considered in the treatment process. To properly manage the in-process waste, the containers will be returned to the RCRA warehouses for temporary storage until final treatment is performed. Due to the multiple treatment processes which will be implemented to complete the Chemical Treatment Project, wastes may be stored for several years awaiting further treatment. Containers will be returned to RCRA storage areas which provide in-place controls and regular inspection schedules.

Figure 4-1 provides a graphic depiction of the waste segregation treatment process. Detailed equipment/process specifications will be provided in a technology specific work plan for Waste Segregation.

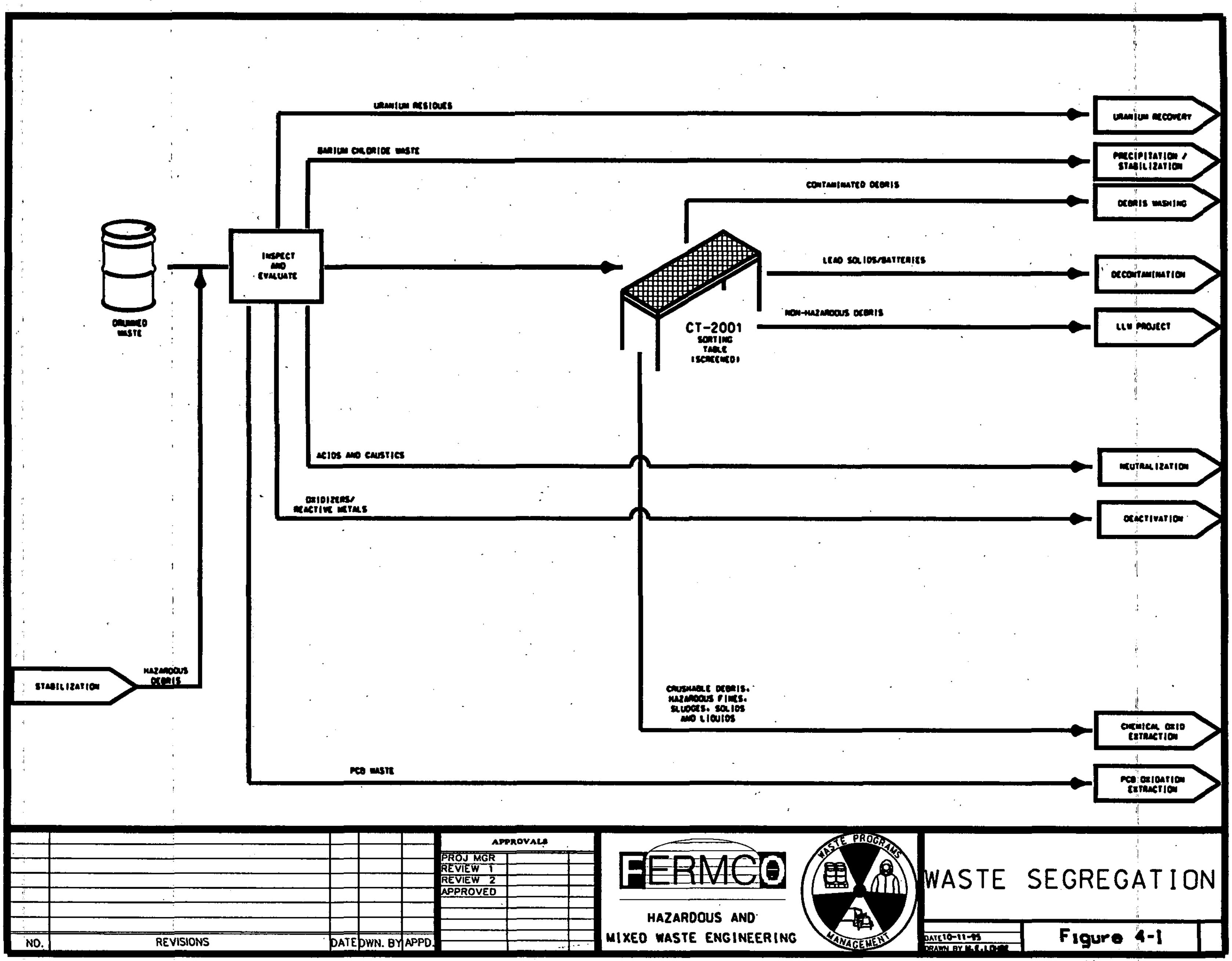

Figure 4-1

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4.3.3 Precipitation/Neutralization

The precipitation/neutralization treatment process will treat two waste categories. The first category is barium chloride waste in the form of floor sweepings and salt residues which require immobilization to meet concentration based treatment standards for the barium and lead contamination. The second is corrosives (i.e., caustic and acidic aqueous liquids) which require neutralization. Neutralization will also be a preliminary treatment step for some waste streams which will require further treatment for organic and inorganic contamination. These two treatment methods have been placed into the same treatment process due to the similarities in treatment units. Both treatment units are solution based treatment processes. The treatment process for performing precipitation would require few modifications to perform neutralization. The following discussions provided are for the conceptual treatment processes. These processes are subject to change. Variations and potential options are also discussed.

Barium chloride waste will be treated by immobilization which includes precipitation of the barium followed by cement stabilization for lead. The highly soluble nature of barium chloride salts and the high barium concentration in the wastes makes precipitation a necessary first step in the treatment process. Precipitation is a chemical process that removes water soluble contaminants from the solution. Reducing contaminant solubility is usually accomplished by the addition of a chemical precipitant that reacts with the contaminant to an insoluble compound. The second step, cement stabilization, transforms the waste so that the hazardous constituents are in a less mobile or toxic form by binding the waste into the matrix of the cement.

Stabilization may be accomplished by using an inorganic binding agent such as Portland cement. Cement-based materials will react with water to form a solid matrix which improves handling and immobilizes the contaminants. The application of the precipitation and stabilization processes in the same vessel provides benefits. It limits the need to add water required to react with the Portland cement and secondary waste stream generation.

The first step of the barium chloride treatment process is shredding or particle size reduction. Particle size reduction increases the total surface area that will be exposed in the dissolving tank. This will accelerate the dissolution process. A vibrating screening table ensures the barium chloride waste entering the dissolving tank meets size specifications. Oversized pieces will be reprocessed through the shredder.

The barium chloride waste must be put into solution with water to perform precipitation. Dissolution is necessary to dissociate the barium from the chlorine ions so precipitation of the barium can occur. The dissolving tank will be equipped with a mixer to facilitate dissolution. Solids such as brick and floor sweepings are not water soluble and will not be dissolved in the dissolution tank.

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When the barium chloride is dissolved, the resulting solution and undissolved solids will be transferred to a precipitation/stabilization vessel. This vessel may be a large tank, a container such as a drum or a vessel similar to a concrete mixer. The precipitating agent (i.e., an inorganic water soluble sulfate) will be added to the solution in the vessel. The mixture will be agitated to assure complete precipitation. When precipitation is complete, a stabilizing reagent such as Portland cement will be added. The mixture will be stirred, then allowed to cure. Additional water will be added to assure proper stabilization, if required. This will result in a more homogeneous product with reduced contaminant mobility and increased structural integrity.

Samples will be taken of the waste prior to curing. The samples will cure, then be analyzed for leachable toxic characteristic metals via the TCLP. Waste meeting LDR standards will be characterized as low level waste and will be eligible for shipment to and disposal at the Nevada Test Site. Waste not meeting LDR standards will be reprocessed.

Figure 4-2 provides a graphic depiction of the barium chloride precipitation. Detailed equipment and process specifications will be provided in the technology specific work plan for Precipitation/Neutralization.

Corrosive wastes consist of caustic and acidic aqueous liquids with a pH greater than or equal to 12.5 or less than or equal to two (2) respectively. The initial treatment process required for these streams to meet LDR standards is neutralization. Neutralization changes the pH of corrosive wastes from alkaline or acidic toward neutral (pH = 7). This pH adjustment, based on the chemical reaction of acids and bases, will eliminate the corrosivity characteristic. The pH is adjusted by controlled addition of a neutralizing agent and mixing sufficiently to reach equilibrium. Treatability studies, cost, and safety factors will be used to determine the most effective neutralizing agent for each waste. Neutralization could include mutual neutralization which is the mixing of acidic and caustic wastes to achieve neutral pH. Mutual neutralization, utilizing wastes as neutralizing reagents, will minimize cost and secondary waste generation. Purchased neutralizing agents may include lime, sodium hydroxide, and sulfuric acid. Additional treatment will be required to treat the corrosive wastes which include organic or inorganic contaminants.

As a first step the corrosive waste will be mixed with the appropriate neutralizing agent in a neutralization tank until thoroughly blended. The neutralization tank will be equipped with an agitator to ensure sufficient mixing until desired pH is achieved. The neutralization tank may be the same vessel as the precipitation dissolution tank or may require slight modification.

After neutralization, the liquids will be evaluated for further treatment. Liquids may be disposed through the FEMP WWTF or shipped to the TSCA Incinerator. Liquids which are characteristic only, may be managed through the WWTF. Neutralized liquids which contain F-listed waste may not be eligible for treatment through WWTF, but will be evaluated on a case-by-case basis. An evaluation will be performed on all liquids considered for disposition through the FEMP WWTF to assure National Pollutant Discharge Elimination System (NPDES) permit limitations and Ohio EPA water quality standards are met. Liquids which are not eligible for the WWTF will either be treated by carbon adsorption, chemical oxidation, chemical extraction, or bulked for shipment to the TSCA Incinerator. Treatability studies are being performed to determine what methods will be best for performing the final treatment. Some pretreatment may be performed prior to implementing these options. Neutralized liquids may be pumped into a clarifier to separate the organic phase of the liquid waste. The separation process may be aided by the addition of chemical reagents. Organic constituents will be bulked for transfer to the TSCA Incinerator. Clarified waste water will be evaluated for treatment through the WWTF. If feasible, organic contaminants may be concentrated through steam stripping, distillation or other methods to minimize waste quantity to be bulked and shipped for incineration.

Figure 4-3 provides a graphic depiction of neutralization. Detailed equipment and process specifications will be provided in the technology specific work plan for Precipitation/Neutralization.

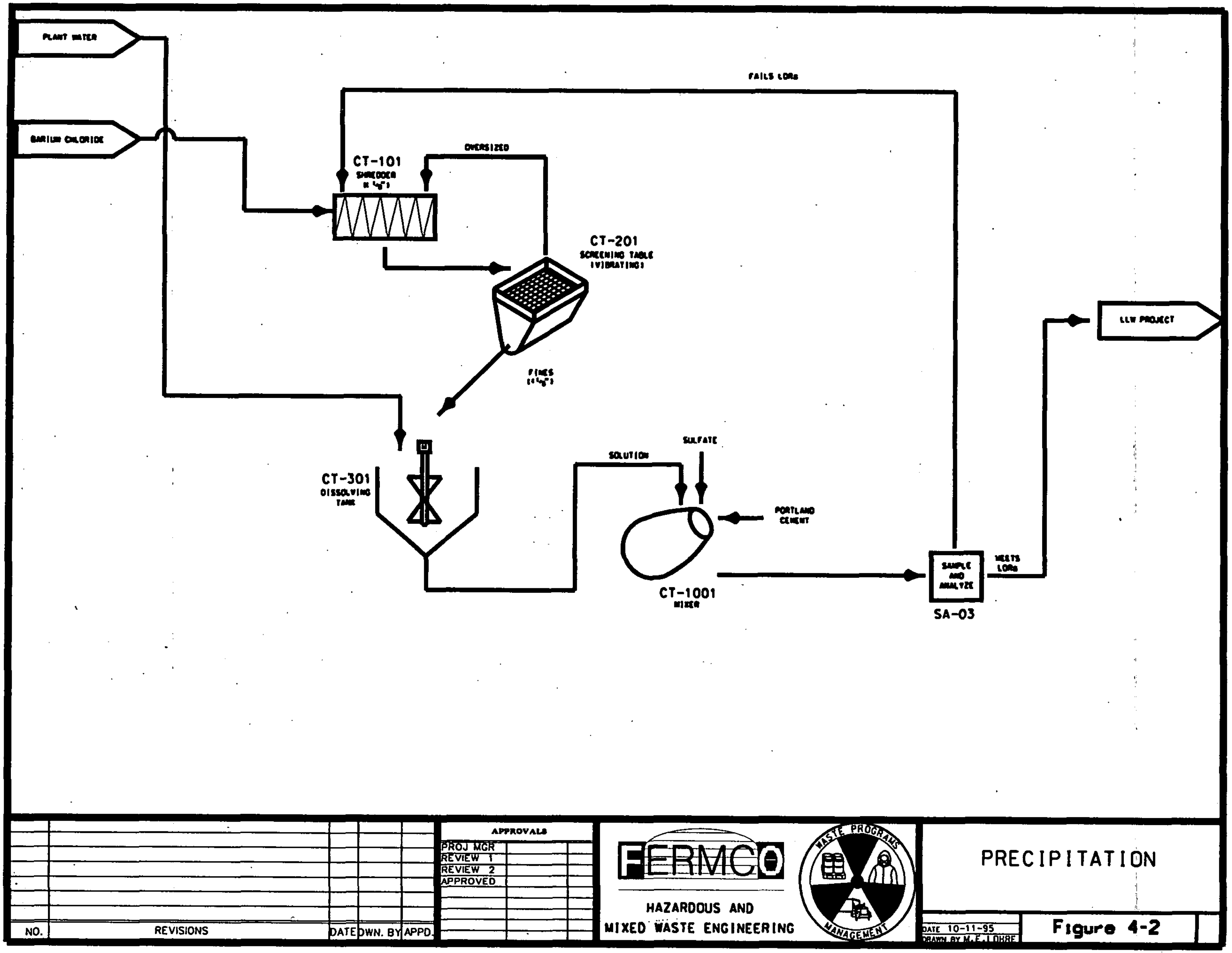

Figure 4-2

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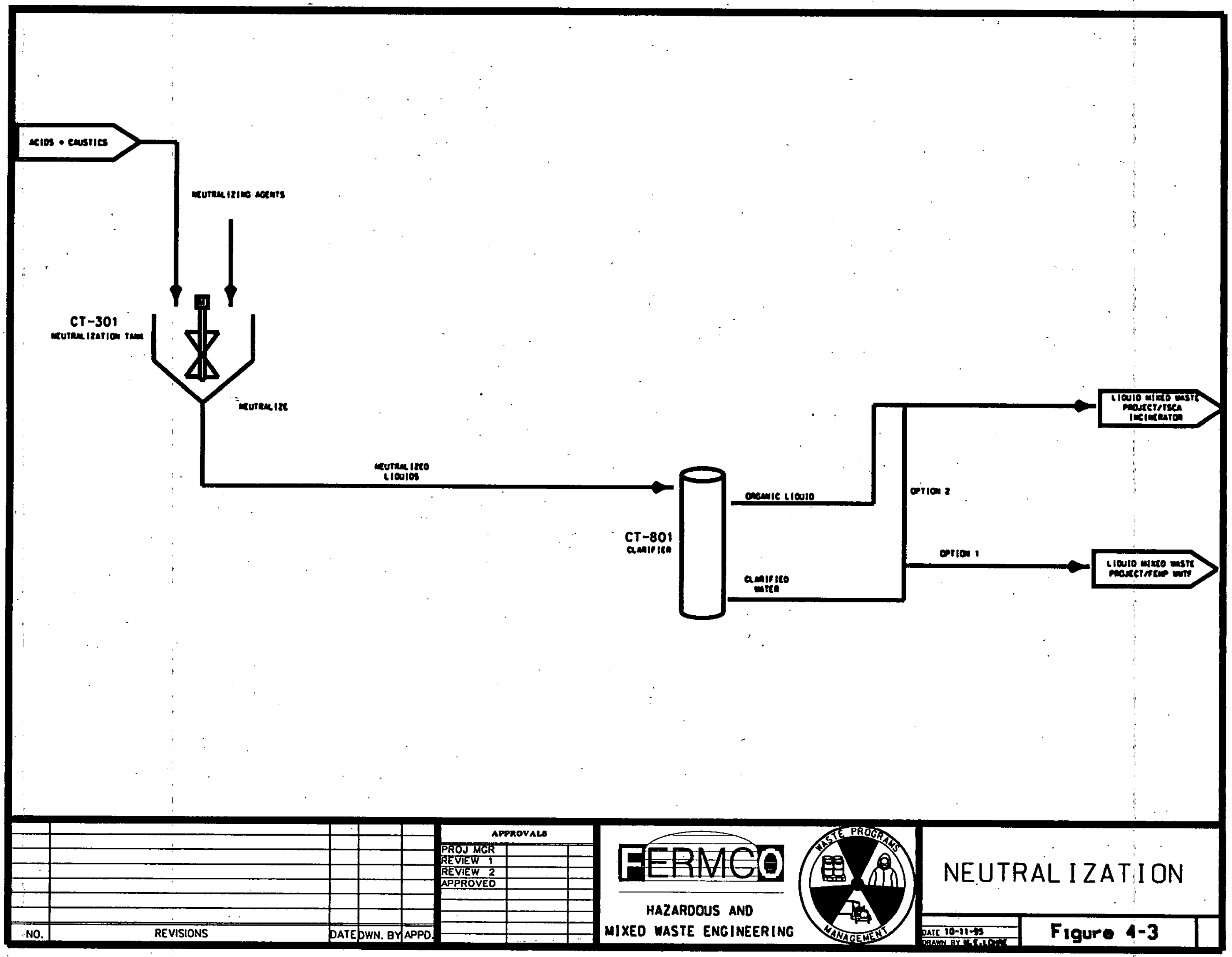

Figure 4-3

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4.3.4 Debris Washing/Decontamination

Debris washing and decontamination are similar technologies whose purpose is to remove contaminants from debris and debris-like material. Debris washing is designed to remove hazardous constituents contained in or on the debris. Decontamination is used to remove radioactive contamination from the surface of inherently hazardous debris such as lead bricks, Ni-Cd and mercury batteries, or other materials. These technologies are included in this treatment process because of the similarities in treatment methods and unit requirements.

Debris contaminated with hazardous waste may be treated by a number of methods to meet LDR standards. Alternative treatment standards were developed by the EPA for debris that include extraction, destruction, and immobilization. Based on research and treatability studies, chemical extraction is currently the preferred options for the treatment of the contaminated debris.

Macroencapsulation of the hazardous debris may be an alternative. Section 4.3.5, describes the macroencapsulation process for debris. It includes placement of debris in an approved plastic container which may prove to be an effective treatment. Procuring containers that meet specifications and cost comparisons between technologies are the determining factors in the technology selection. If macroencapsulation is selected, debris washing will not be required.

Chemical extraction would be implemented in the form of debris washing. Debris washing will consist of washing the contaminated debris in a water bath/spray with sufficient detergent, pressure, residence time, and agitation to remove hazardous contaminants from debris surfaces and surface pores. Treatment must meet contaminant restrictions and performance/operating standards. Residue from the treatment of hazardous debris must be separated from the treated debris using simple physical or mechanical means and treated to meet constituent specific LDR standards.

The performance standard which the debris washing must meet is treatment to a "clean debris surface". A "clean debris surface" requires that the debris surface be virtually free of all visible contamination from hazardous waste when viewed without magnification. Residual staining from hazardous waste and hazardous waste in cracks and crevices may be present but must not exceed 5% of the surface area. Staining from nonhazardous sources (i.e., grease) will not be factored in this percentage. Treatability studies indicate that distinguishing stains from hazardous waste and nonhazardous sources through visual inspection for some waste types (i.e., rags) will be time consuming and is contingent upon detailed knowledge of the waste stream. Determinations on meeting "clean debris surface" criteria rely heavily on analytical results from treatability studies for debris washing.

Contaminated debris would be segregated during the waste segregation operation into subcategories designed to increase the efficiency of the washing operation. Segregated debris may be shredded for size reduction as a pretreatment step. Any debris determined not amenable to size reduction would be set aside and evaluated for treatment. Size reduction is necessary to meet operational standards and ensure all surfaces will contact the wash solution. For brick, cloth, concrete, paper, pavement, rock, and wood, debris must be not more than 1.2 cm (1/2") thick in one dimension. Shredded debris would be conveyed to a vibrating screening table to ensure the debris meets dimensional criteria. Fines and sludges falling through the screen would be collected in containers and placed into storage to await further treatment. The contaminated debris would be conveyed to the debris washer.

The application of the chemical extraction technology for the soft solids will resemble that of a laundry washing machine. A high pressure spray wash may be utilized for the hard solids. Design flexibility may allow either or both applications in one unit. Water and detergent will be blended in a detergent mix tank prior to entering the debris washer. Minimum standards require contaminants to be soluble in the detergent solution to at least 5% by weight in emulsion, and debris surfaces must remain in contact with the solution for at least 15 minutes.

When washing is complete, debris will be separated from the residual wash water. A sieve basket inside the debris washer may be used to retain the debris while wash water is drained from the washer. Incorporation of a spin cycle and/or a drying cycle may be required for adequate water removal. Wash water will be pumped to a holding tank or clarifier for further treatment.

After washing, the debris will be visually inspected to determine if the performance criteria of a clean debris surface is met. Visual inspection may take the form of an operator viewing debris as it passes on a conveyor. When debris is spotted which does not meet the criteria of a clean debris surface, it will be removed and returned to the washer for further processing. The scrutiny of the visual inspection will be determined on the results of the treatability study. Debris not meeting the clean criteria will be returned to the treatment process for additional washing. If multiple washing fails to clean the debris, the debris will be transferred to the macroencapsulation inventory. Clean debris is no longer hazardous and may be disposed as low level waste.

Waste water from the washer will be evaluated for further treatment. Waste water may be treated through the FEMP WWTF or shipped to the TSCA Incinerator. Liquids which are characteristic only may be managed through the WWTF. Waste waters which contain F-listed waste may not be eligible for treatment through the WWTF. These waste waters will be evaluated for treatment in the WWTF on a case-by-case basis. Liquids which are not eligible for the WWTF may either be treated by carbon adsorption, chemical extraction, chemical oxidation, or bulked for shipment to the TSCA Incinerator. An evaluation will be performed on all liquids considered for disposition through the FEMP WWTF to assure NPDES permit limitations and Ohio EPA water quality standards are met. Treatability studies are being performed to determine what methods will be best for performing final treatment. Pretreatment may be performed prior to implementing these options. Wash waters may be pumped into a clarifier to separate the organic phase. The separation process may be aided by the addition of chemical reagents. The organic portion will be bulked for transfer to the TSCA Incinerator. Clarified waste water will be evaluated for treatment through the WWTF. If feasible, the organic contaminants may be concentrated through steam stripping, distillation or other methods minimizing the quantity of waste to be bulked and shipped for incineration.

Figure 4-4 provides a graphic depiction of Debris Washing. Detailed equipment and process specifications will be provided in a technology specific work plan for Debris Washing/Decontamination.

Lead solids and hazardous batteries with radioactive surface contamination will go through a decontamination process. Contaminated lead solids and batteries must be decontaminated to meet "free release" criteria prior to disposition to a recycling facility. Successful decontamination will remove radioactive contaminants from the surface of the material. If decontamination fails to remove the contaminants, the contaminated lead solids will require macroencapsulation.

All lead solids will be monitored for "free release". Radiological surveys will measure the level of radiological contamination. Lead solids which pass the "free release" criteria will be shipped to an approved lead recycling facility. Radioactively contaminated solids may be wiped with a special cloth and detergent, or sent to a decontamination bath to remove contamination. Treatment time will be adjusted to achieve adequate decontamination. After removal from the decontamination bath, the solids will be rinsed, dried, and radiologically surveyed for "free release". Solids meeting "free release" criteria will be recycled. If decontamination fails, macroencapsulation will be required, (see Section 4.3.4). Spent solution from the decontamination bath will be evaluated to determine if processing through the FEMP WWTF is possible.

Alternative treatment options for these materials includes direct shipment of contaminated lead solids or batteries to a facility permitted to accept radioactively contaminated hazardous waste. The waste will be treated at the facility to meet LDR. The options will be evaluated for feasibility and cost effectiveness.

Figure 4-5 provides a graphic depiction of the decontamination treatment process description. Detailed equipment and process specifications will be provided in the technology specific work plan for Debris Washing/Decontamination.

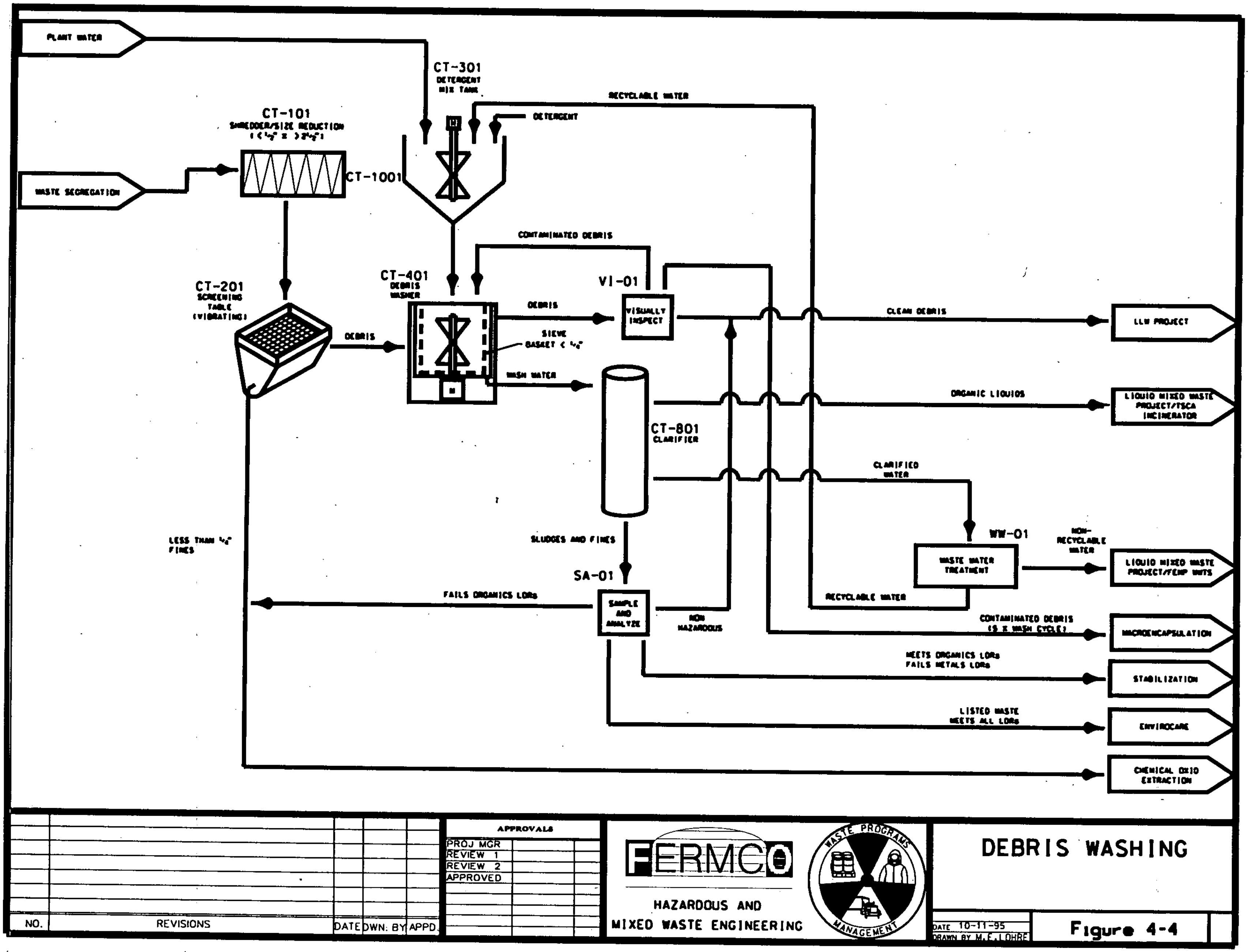
PLANT WATER
CT-301
DETERGENT MIX TANK
RECYCLABLE WATER
DETERGENT
CT-101
SHREDDER/SIZE REDUCTION
WASTE SEGREGATION
CT-1001
CONTAMINATED DEBRIS
CT-201
SCREENING TABLE (VIBRATING)
CT-401
DEBRIS WASHER
VI-01
VISUALLY INSPECT
DEBRIS
SIEVE BASKET
WASH WATER
CLEAN DEBRIS
LLW PROJECT
ORGANIC LIQUIDS
LIQUID MIXED WASTE PROJECT/TSCA INCINERATOR
CT-801
CLARIFIER
CLARIFIED WATER
WW-01
WASTE WATER TREATMENT
NON-RECYCLABLE WATER
LIQUID MIXED WASTE PROJECT/FEMP WWTS
LESS THAN ¼" FINES
SLUDGES AND FINES
SA-01
SAMPLE AND ANALYZE
FAILS ORGANICS LDRs
NON HAZARDOUS
RECYCLABLE WATER
CONTAMINATED DEBRIS (5 X WASH CYCLE)
MACROENCAPSULATION
MEETS ORGANICS LDRs FAILS METALS LDRs
STABILIZATION
LISTED WASTE MEETS ALL LDRs
ENVIROCARE
CHEMICAL OXID EXTRACTION
APPROVALS
PROJ MGR
REVIEW 1
REVIEW 2
APPROVED
NO.
REVISIONS
DATE
DWN. BY
APPD.
FERMCO
HAZARDOUS AND
MIXED WASTE ENGINEERING
WASTE PROGRAMS MANAGEMENT
DEBRIS WASHING
DATE 10-11-95
DRAWN BY M.E. LOHRE
Figure 4-4

Figure 4-4

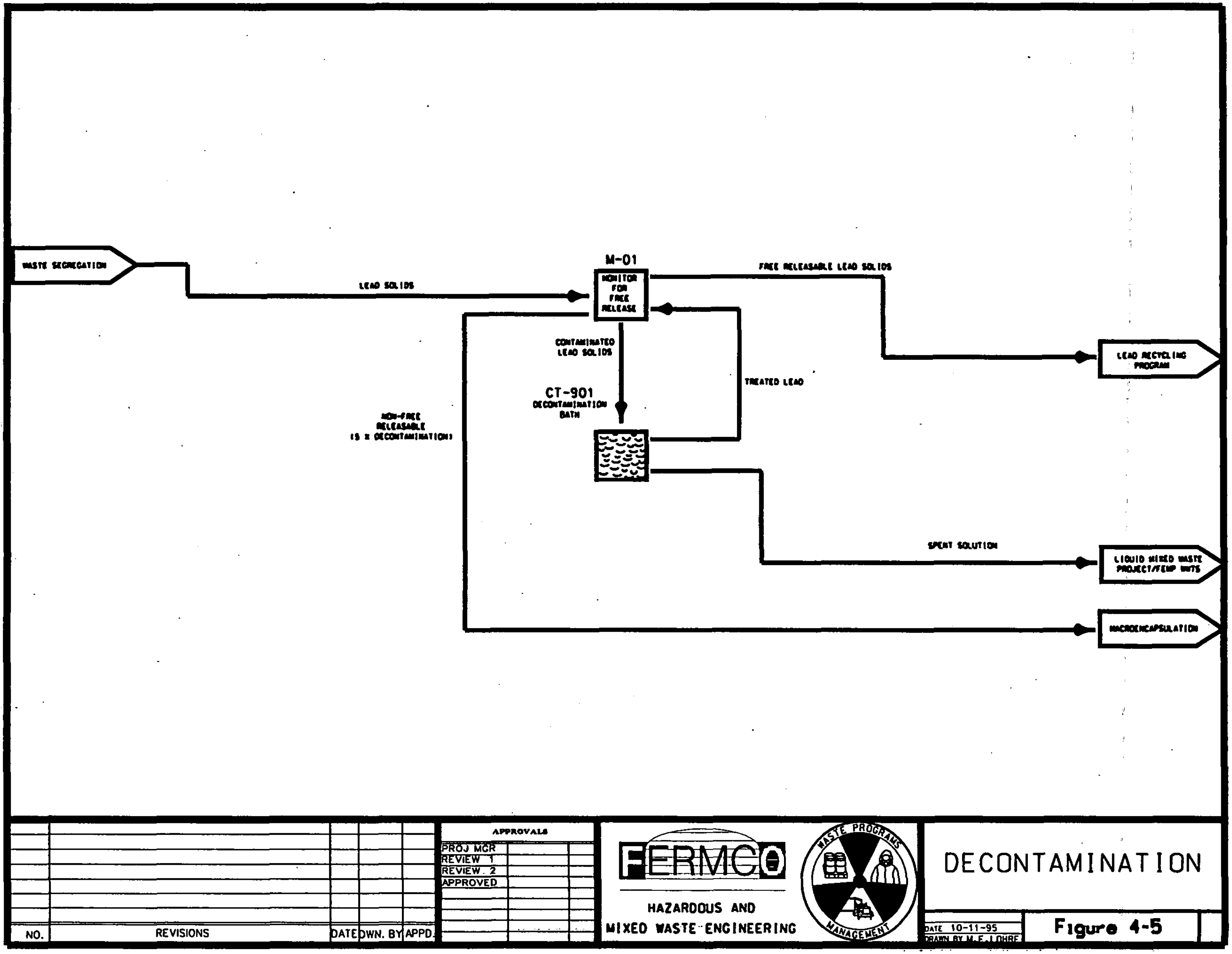

Figure 4-5

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4.3.5 Macroencapsulation

Macroencapsulation uses surface coating materials or a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media. Macroencapsulation is the technology based standard for radioactive lead solids and debris. Macroencapsulation is an alternative treatment to debris washing. If debris washing is selected, debris which fails to meet the "clean debris surface" performance standard after multiple washing cycles will require macroencapsulation. Macroencapsulation will be required for batteries or lead solids that do not meet "free release" criteria following decontamination attempts. The encapsulating material must completely encapsulate the waste and be resistant to degradation by the waste and its contaminants, and any materials it may contact after final disposition.

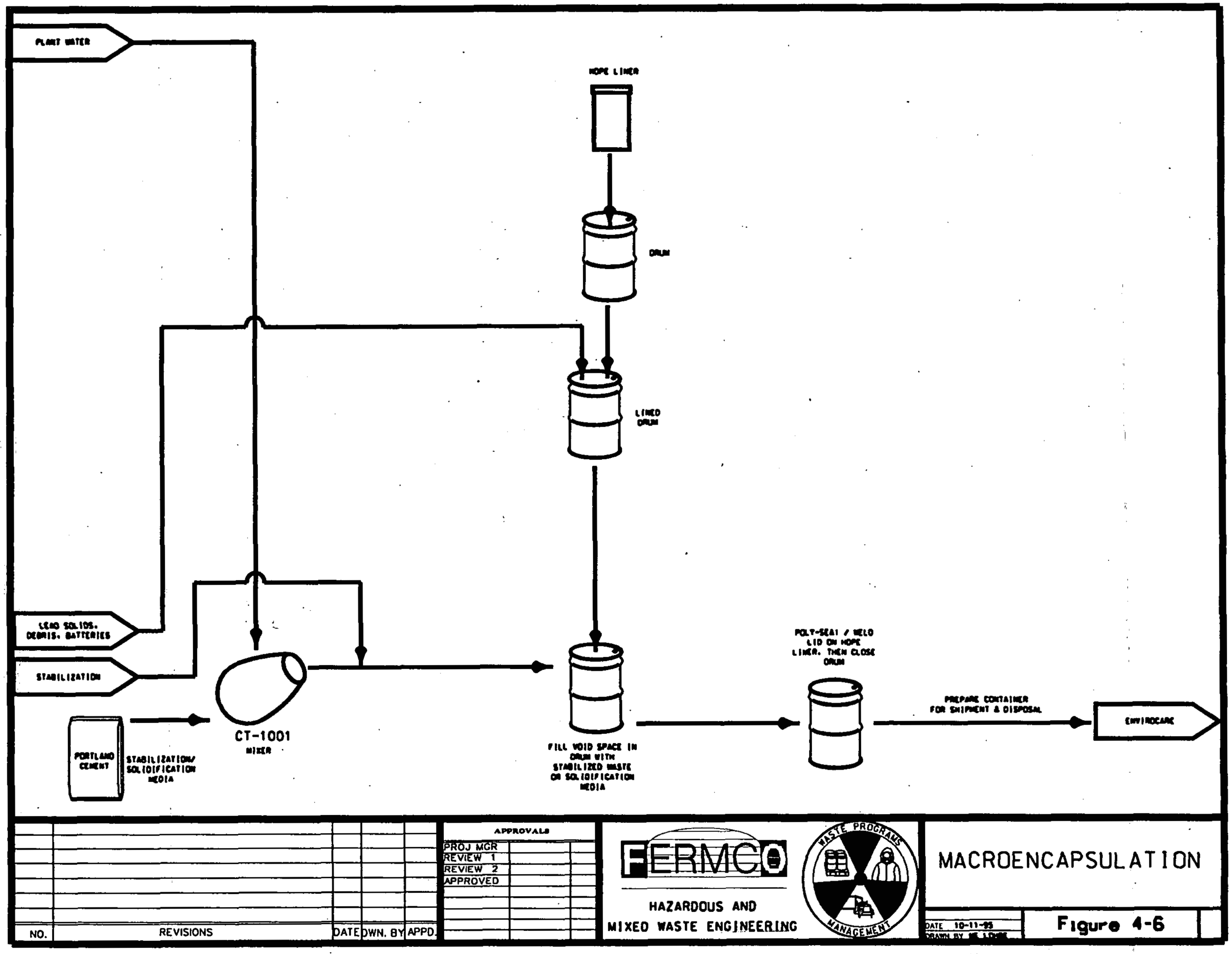
There are two definitions for macroencapsulation: one for the treatment of lead solids and another is for treatment of hazardous debris. In treatment specifications for radioactive lead solids, the use of any material classified as a tank or container is prohibited. This prohibition is not included in the definition for the treatment of hazardous debris. Therefore, macroencapsulation in a sealed container that meets structural specifications and resists degradation is acceptable for debris, but not lead. If macroencapsulating the debris in a container proves to be an effective and cost efficient treatment, debris washing (Section 4.3.4) will no longer be necessary. Material which is macroencapsulated must be dispositioned at a permitted mixed waste disposal facility.

Macroencapsulation is not the treatment standard for Ni-Cd or mercury batteries. The treatment standard for these batteries is recovery. Due to radioactive contamination, batteries cannot be effectively treated by this specified treatment standard. Radioactively contaminated batteries require decontamination to free-release standards prior to recycle. If decontamination fails, the FEMP must utilize alternative treatment methods. Section 4.3.1 discusses alternative treatment requirements. Additional information on variances will be provided in the technology specific work plans.

Macroencapsulation of radioactive lead solids and batteries must include coating or jacketing the surfaces to reduce potential leaching. This may include the use of a plastic capsule, total encapsulation with concrete, or a combination of both. Macroencapsulation of debris may utilize a container which is nondegradable and meets specified criteria. The first stage of the macroencapsulation process may involve placing the lead solids in a high density polyethylene (HDPE) lined drum. Void spaces in the drum will be filled with a stabilization/solidification media such as Portland cement as the encapsulating agent. This may include the use of Portland cement mixed with waste. The liner lid may be poly-sealed or welded shut prior to drum closure. Encapsulated waste would then be disposed at a mixed waste disposal facility. Debris may employ a similar encapsulation method, but may not include the use of cement as the encapsulating agent.

An alternative approach to performing macroencapsulation on-site is to send untreated waste to a TSDF permitted to provide macroencapsulation services. Thereby, the FEMP would ship waste directly to be treated and disposed by the TSDF.

Figure 4-6 provides a graphic depiction of the treatment process description. Detailed equipment and process specifications will be provided in the technology specific work plan for macroencapsulation.


PLANT WATER
HDPE LINER
DRUM
LINED DRUM
LEAD SOLIDS, DEBRIS, BATTERIES
STABILIZATION
PORTLAND CEMENT
STABILIZATION/ SOLIDIFICATION MEDIA
CT-1001
MIXER
FILL VOID SPACE IN DRUM WITH STABILIZED WASTE OR SOLIDIFICATION MEDIA
POLY-SEAL / WELD LID ON HDPE LINER, THEN CLOSE DRUM
PREPARE CONTAINER FOR SHIPMENT & DISPOSAL
ENVIROCARE
NO.
REVISIONS
DATE
DWN. BY
APPD.
APPROVALS
PROJ MGR
REVIEW 1
REVIEW 2
APPROVED
FERMCO
HAZARDOUS AND MIXED WASTE ENGINEERING
WASTE PROGRAMS MANAGEMENT
MACROENCAPSULATION
Figure 4-6

Figures 4-6

4.3.6 Deactivation

Reactive and oxidizer waste will undergo deactivation. Deactivation is the technology standard for hazardous characteristics of ignitability, corrosivity, and reactivity. The standard for deactivation of the hazard is set by the definition of the hazard characteristic. Following deactivation, the waste must no longer exhibit the defined characteristic.

Deactivation can take the form of a number of treatment processes. This includes mixing the waste with a chemical reagent neutralizing its hazardous characteristic(s). Another option is to slowly react the waste in a controlled manner to convert the waste to a nonhazardous form. Waste may also be placed in a Portland cement or a petroleum based cement (Petroset). This will isolate the waste, limiting its exposure and prevent any type of sustained reaction.

If cement stabilization is used, the first stage of the deactivation process may include size reduction. Size reduction would be required to ensure the waste is appropriately "deactivated". Cooling oil may be used to assure reactive waste does not ignite when size reduced. A vibrating screen table segregates oversized waste before it is conveyed to the mixer for stabilization. Oversized waste will be recycled through the size reducer for proper size reduction.

Stabilizing agents such as Portland cement, Petroset, or other additives will be mixed with the shredded waste. Stabilizing agents and additives will be chosen based on their ability to deactivate the waste and meet disposal facility WAC. After deactivation, the waste will no longer exhibit the hazardous characteristic. Sampling and analysis will be performed, as necessary, to verify proper treatment was performed. Deactivated waste meeting LDR standards is eligible for disposal as low level waste. Waste failing the standards will be reprocessed beginning with size reduction.

Figure 4-7 provides a graphic depiction of deactivation. Detailed equipment and process specifications will be provided in the technology specific work plan developed for Reactives/Oxidizer Deactivation.

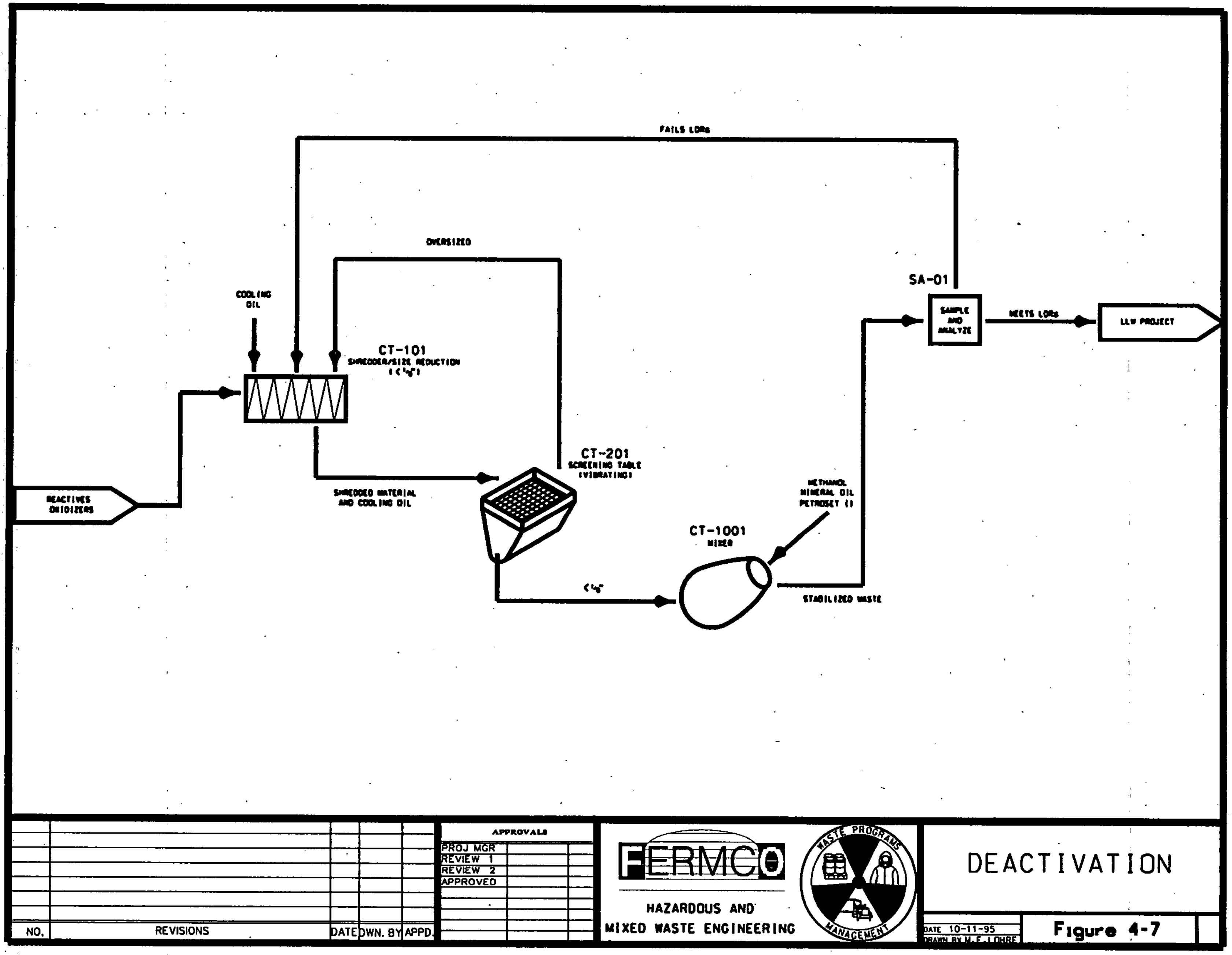

FAILS LDRs
OVERSIZED
COOLING OIL
CT-101
SHREDDER/SIZE REDUCTION
CT-201
SCREENING TABLE (VIBRATING)
SHREDDED MATERIAL AND COOLING OIL
REACTIVES OXIDIZERS
METHANOL
MINERAL OIL
PETROSET II
CT-1001
MIXER
STABILIZED WASTE
SA-01
SAMPLE AND ANALYZE
MEETS LDRs
LLW PROJECT
APPROVALS
PROJ MGR
REVIEW 1
REVIEW 2
APPROVED
NO.
REVISIONS
DATE
DWN. BY
APPD.
FERMCO
HAZARDOUS AND
MIXED WASTE ENGINEERING
WASTE PROGRAMS MANAGEMENT
DEACTIVATION
DATE 10-11-95
Figure 4-7

Figure 4-7

4.3.7 Chemical Extraction/Oxidation

Treatment for fines, sludges, and soils will, to the extent practicable, utilize ambient temperature treatment, such as solvent extraction or chemical oxidation. This is consistent with the preferences discussed in Section 1.0 of this document. Some of these waste streams contain halogenated organics which do not have specified treatment standards, in excess of 1,000 ppm and require incineration per LDR standards. An alternative treatment method will be evaluated. Section 4.3.1 discusses the alternative treatment requirements. Solvent extraction consists of contacting a solvent with contaminated waste to preferentially dissolve contaminants into the solvent. Only when contaminants are highly soluble and the solid matrix is relatively insoluble in the solvent is extraction effective.

Chemical oxidation is used to reduce toxicity of hazardous constituents or destroy organics without the use of elevated temperatures. An oxidizing agent such as hydrogen peroxide (H_2O_2) is reacted with contaminants while both reactants are in solution. Chemical oxidation is suited to treatment of liquids or sludges with low organic content. Treatment can be optimized by adjusting pH, temperature, and contact time. Based on organic constituent concentrations and waste streams matrices, chemical oxidation will probably not be used to treat the primary waste streams. However, it may be used to treat secondary waste streams generated as a result of the primary extraction treatment process (i.e., wash waters).

Preference is given to treatment processes performed at ambient temperatures, however, use of low temperature thermal treatment processes may be required for treatment of fines, soils, and sludges if ambient temperature technologies are not feasible. Typical low temperature thermal treatment processes include thermal desorption, distillation, steam stripping, or other treatment processes not employing high temperature thermal destruction.

The conceptual treatment process is solvent extraction. Solvent(s) for the extraction process may consist of extraction reagents blended with water or an organic solvent (i.e, isopropyl alcohol, butane, propane, or alcohol). Treatability studies will determine efficient reagents for all contaminants. After extraction, the solvent and contaminant will be decanted, segregating treated solids from contaminated solvents. Additional treatment of sludges may be required to remove residual solvents (i.e., drying) from treated solids. The basis for solvent selection for chemical extraction is the ability to dissolve and remove contaminants from the waste matrix. Additional criteria for solvent selection include:

- ease of use (i.e., flammability, toxicity, volatility)
- primary waste pretreatment requirements to use the solvents
- solvent recyclability
- cost of solvent
- regulatory status of spent solvent
- post-treatment requirements

Pretreatment for extraction would include particle size reduction through a shredder. Particle size reduction increases extraction efficiency by increasing particle surface area and contact between the solids and solvent. A vibrating screening table will ensure waste entering the extraction vessel meets size specifications. Oversized waste will recycle through the shredder until particle size specifications are met.

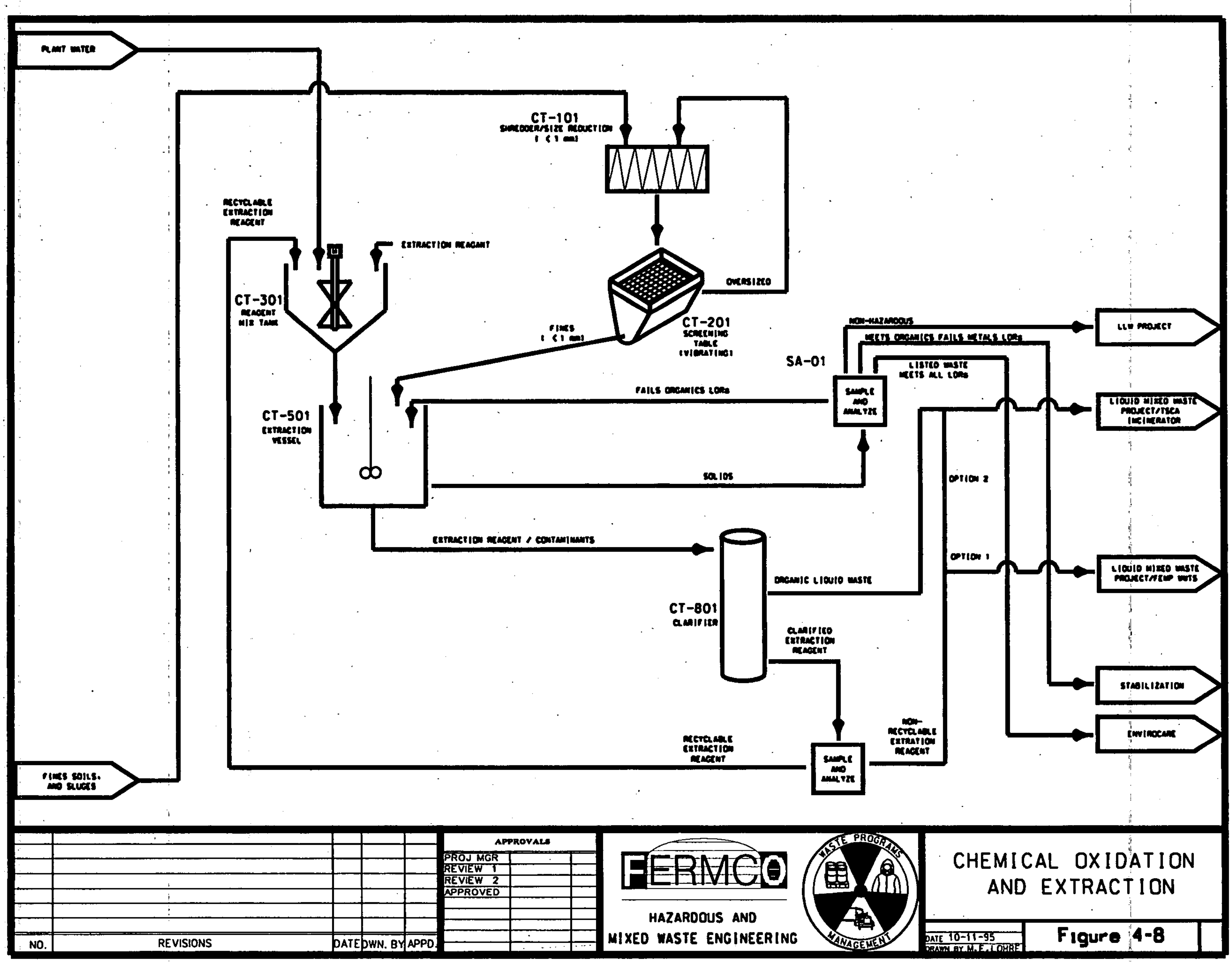
A reagent mix tank will blend the additives for the extraction process. To the extent practical, the extraction reagent will be recycled. Recycling treatment technologies may include steam stripping, chemical oxidation, carbon adsorption, or distillation. Solvent reuse is contingent upon the ability of the solvent recycling process to remove contaminants and effectiveness of reused solvents.

Size reduced waste and the blended extraction solvent will be combined in the extraction vessel. The vessel may be equipped with agitation to increase the amount of contact between the waste and solvent. After sufficient residence time, the extraction solvent and the solubilized contaminants will be decanted. The solid fraction of the separation process will be sent for sampling and analysis. Additional treatment of the sludges may be required to remove residual solvent from the treated solids. This may include drying, or a rinse to remove residual solvent.

Sampling and analysis will be performed on the solids to determine if the waste meets LDRs. Solids failing LDRs will be reprocessed for organics or stabilized for metals. The solids may be reprocessed several times to ensure satisfactory removal of contaminants. The number of reprocessing times will be determined based on the selected process, treatability studies and analytical data. Treated waste meeting LDR will be evaluated for disposition to a LLRW disposal facility, or mixed waste disposal facility.

Spent extraction solvent which can no longer be recycled will be evaluated for further treatment. Spent solvent may be treated through the FEMP WWTF or shipped to the TSCA Incinerator. Liquids which are characteristic only may be managed through the WWTF. Spent solvents containing F-listed waste may not be eligible for disposal through the WWTF, but will be evaluated on a case-by-case basis. Liquids which are not eligible for treatment through the WWTF may either be treated by carbon adsorption, chemical extraction, chemical oxidation, or bulked for shipment to the TSCA Incinerator. Treatability studies are being performed to determine optimum methods for performing final treatment. Pretreatment may be performed prior to implementing these options. Spent solvent may be pumped into a clarifier to separate the organic phase of the solution. Chemical reagents may be added to aid the separation process. The organic portion will be bulked for transfer to the TSCA Incinerator. Clarified waste water will be evaluated for disposal through the WWTF. Organic contaminants may be concentrated through steam stripping, distillation or other methods to minimize waste to be bulked and shipped for incineration.

Figure 4-8 provides a graphic depiction of the treatment process description. Detailed equipment and process specifications will be provided in the technology specific work plan for Chemical Extraction/Oxidation.



000051

Figure 4-8

4.3.8 PCB Chemical Oxidation/Extraction

The PCB waste category consists of PCB waste streams with RCRA contaminants (tri-mixed) and no RCRA contaminants. Regulations state that the treatment based standard for PCB contaminated waste is incineration. However, no permitted facility has the capacity to incinerate radioactively contaminated PCB solids. The FEMP will investigate non-thermal treatment of mixed waste. Documentation will be submitted in the technology specific work plan for approval of an alternative technology. Thermal desorption, base-catalyzed dechlorination, and solvent extraction are a few of the available alternative technologies. The most likely alternative technology candidate is a solvent extraction process similar to that described for the soils, fines, and sludges.

Solvent extraction consists of contacting solvents with contaminated solids or sludges to preferentially dissolve the contaminant (i.e., PCB and organic solvents) into the solvent. Only when contaminants are highly soluble and the solid matrix is relatively insoluble in the solvent, is solvent extraction effective. The extracting process involves intimate contact of the contaminated solids and the solvent to achieve high extraction efficiencies.

The solvent or extraction reagent may be an alcohol, acetone, butane, propane or other applicable reagent. Treatability studies will determine the best reagent for treatment. After adequate extraction, the contaminant-rich solvent will be segregated from treated solids.

The primary basis for selection of the solvent for chemical extraction is the ability to dissolve the contaminants and remove them from the waste matrix. Additional criteria for solvent selection include:

- ease of use (i.e., flammability, toxicity, volatility)
- primary waste pretreatment requirements to use the solvents
- solvent recyclability
- cost of solvent
- regulatory status of spent solvent
- post-treatment requirements

Pretreatment would include particle size reduction through a shredder. A vibrating screening table will ensure waste entering the extraction vessel meets size specifications. Oversized waste will recycle through the shredder until particle size specifications are met. Particle size reduction increases extraction efficiency by increasing particle surface area and contact between solids and solvent. Pretreatment may also include a drying stage utilizing low heat, or slurrying the waste with water or alternative reagent to make the waste more amenable to primary treatment.

To the extent practicable, the spent extraction reagent will be recycled. Recycling treatment technologies may include steam stripping, chemical oxidation, carbon adsorption, or distillation. Solvent reuse is contingent upon the ability of the solvent recycling process to remove contaminants and effectiveness of reused solvents.

Size reduced waste and the blended extraction solvent will be combined in the extraction vessel. The vessel may be equipped with agitation to increase contact between the waste and the solvent. After sufficient residence time, the extraction solvent with the solubilized contaminants will be decanted. The solid fraction will be sampled and analyzed. Additional treatment of sludges may be required to remove residual solvent from treated solids. This may include drying or a rinse to remove residual solvent.

Sampling and analysis will be performed on the solids to determine if the treated waste meets specified standards of the chosen treatment process for PCBs and LDR standards. These PCB standards will be stated in the alternative treatment approval received from the agencies. Solids failing standards may be reprocessed for organics or stabilized for metals. Solids may be reprocessed several times to ensure removal of contaminants. The number of reprocessing cycles will be determined based on the selected process treatability studies and analytical data. Treated waste meeting treatment specifications and LDR standards will no longer be TSCA regulated. This waste will be evaluated for disposition at a LLRW disposal facility or mixed waste disposal facility.

Spent extraction solvent no longer recyclable will be bulked for shipment to the TSCA Incinerator for incineration. Organic contaminants may be concentrated through steam stripping, distillation or other method to minimize the quantity of waste to be bulked and shipped for incineration.

Figure 4-9 provides a graphic depiction of the treatment process. Process changes may be dictated by the alternative technology approval. Detailed equipment and process specifications will be provided in the technology specific work plan for PCB Chemical Oxidation/Extraction.

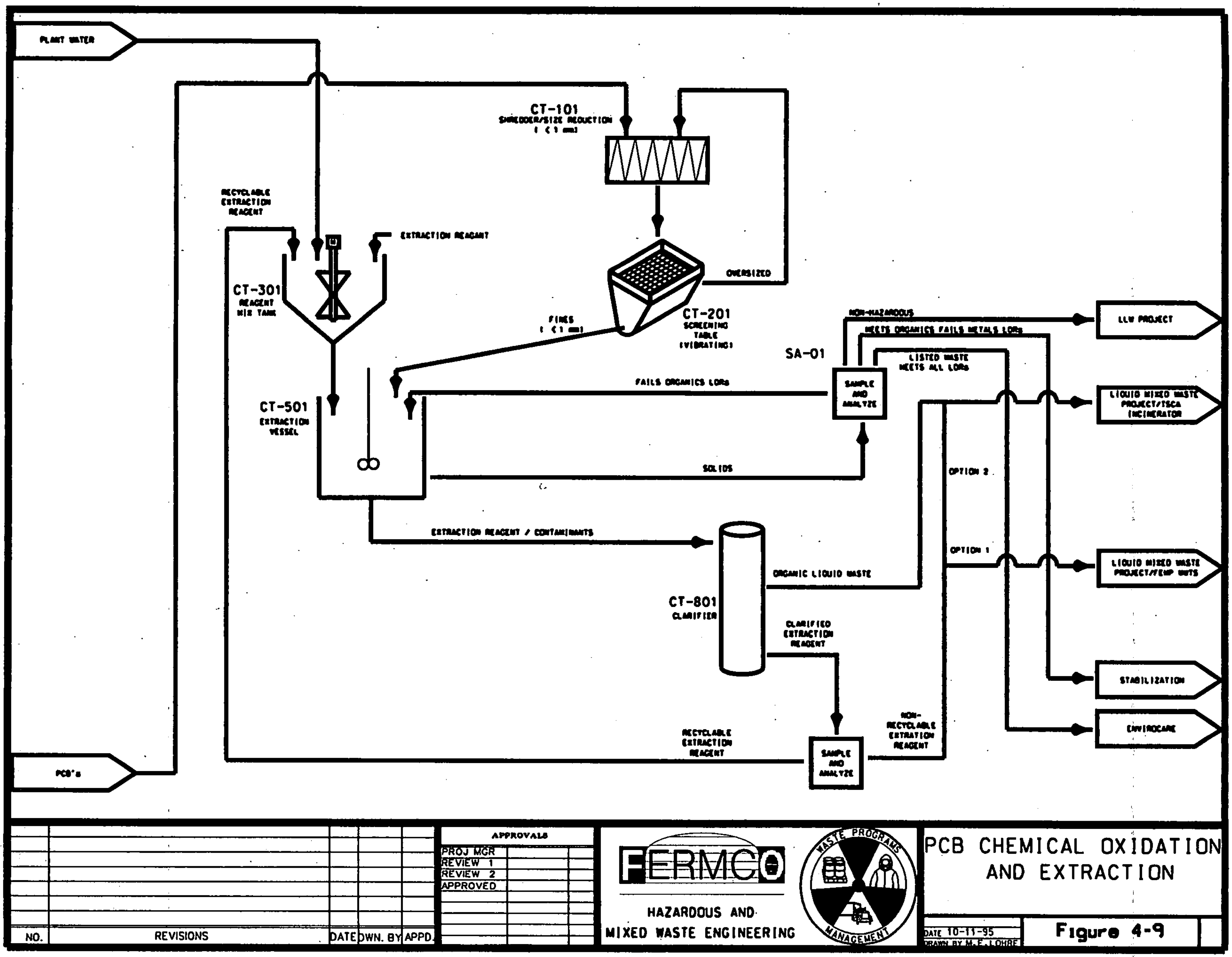


Figure 4-9

000054

4.3.9 Uranium Recovery

Uranium residues consist primarily of uranium oxides above the economic discard limit (EDL). These uranium residues are not classified as waste per DOE Orders, but are considered recoverable residues. The EDL is based on a combination of the percentage of uranium by weight in the residue, and the percentage of U_{235} in the uranium (i.e., enrichment). In the conceptual treatment process, uranium residues will be processed to remove impurities and produce a marketable uranium product. Uranium will be refined to internationally defined American Society for Testing and Materials (ASTM) standards. Maximum impurity limits for various elements are listed in the standards. Residues generated during the process will continue to be managed as mixed waste and may require treatment.

Uranium residues consist of two primary waste streams. Those which contain leachable arsenic in excess of the regulatory limit, and those which are F-listed based on the derived from rule. The F-listed residues meet the LDR standards and may be disposed without further treatment. However, F-listed residues exceed the radiological license limits for the available disposal facility. Reprocessing is suggested to purify the residues to produce a product available for resale. This is consistent with its status as a recoverable residue under DOE Orders. The use of uranium recovery is contingent upon the marketability for the final product. If no market is available for purified residues or if the process is determined not to be cost effective, alternate measures will be taken. These measures would require formal determination by DOE to declare the residues waste. If this occurs, F-listed residues will require blending to reduce the radiological concentration to meet mixed waste disposal facility WAC. Arsenic contaminated residues will be processed through stabilization. Stabilized waste may then be declared nonhazardous and are eligible for disposal as LLRW at the NTS.

Uranium residues may be treated using precipitation and/or solvent extraction methods for recovery of uranium. Treatability studies will determine the technology choice. At this time, precipitation is the most likely process candidate. However, additional processes will be considered as they are identified.

Precipitation is a chemical process to remove soluble contaminants from a liquid matrix. A chemical precipitant reacts with the contaminant to form an insoluble compound. Precipitation will be used to purify and concentrate uranium oxides. Impure uranium residues will be dissolved in nitric acid. When dissolution is complete, the pH will be adjusted to an optimum level (pH = 2). Adjusting pH limits the precipitation of metal contaminants and optimizes uranium precipitation. A precipitating agent such as hydrogen peroxide will be added subsequent to pH adjustment. The resulting precipitate is a purified form of uranium oxide (UO_4) available for further processing. The majority of impurities and contaminants remain in solution. Solid/liquid separation will be accomplished using a simple filtration system such as a filter press, vacuum or gravity filtration.

The uranium recovery process may be changed or include additional steps. Variations in processing may be required to produce an alternate final product such as uranyl nitrate or other forms of oxides. Solvent extraction may be used prior to precipitation to achieve maximum uranium removal. The following discussion is the conceptual treatment process description.

Bar screening will be used to remove trash from uranium residues prior to shredding. Gross contamination will be washed from segregated trash in a bath or a spray wash. Next, uranium oxides will be conveyed to a shredder for size reduction. A vibrating screening table will ensure residues entering the dissolution tank meet size specifications. Oversized pieces will be reprocessed through the shredder. Particle size reduction increases efficiency of the dissolution process. Nitric acid, water, and residues will be stirred in a dissolving tank until dissolution is complete. Undissolved solids will be segregated from the solution by filtration.

The filtrate will be pumped to a precipitation vessel. Ammonium hydroxide will be added to the solution to adjust the pH to approximately 2.0. Once the pH is properly adjusted, a solution of hydrogen peroxide and oxalic acid will be stirred into the uranium solution. When precipitation is complete, filtration will separate uranium oxide (UO_4) cake from the filtrate.

The uranium cake will be rinsed to remove impurities and then dried. Sampling and analysis will be performed on the cakes to ensure ASTM standards are met. Cakes failing standards will be evaluated for reprocessing.

Both wash water and filtrate generated during uranium processing will be combined in a secondary precipitation vessel. After pH adjustment, a reagent will be added to precipitate the remaining contaminants. Filtration will separate the waste into a sludge fraction and liquid fraction.

Sampling and analysis will be performed on undissolved solids and sludges to determine if the waste meets LDRs. Solids failing LDRs will be reprocessed or stabilized. Nonhazardous material will be eligible for disposal as low level waste. Mixed waste meeting LDRs will be dispositioned at a permitted disposal facility.

The liquid fraction or filtrate from the precipitation vessel will be neutralized, then analyzed to determine whether waste water treatment or incineration is required. If practical, nitric acid will be recycled.

Figure 4-10 provides a graphic depiction of the treatment process description. Detailed equipment and process specifications will be provided in the technology specific work plan for Uranium Recovery.

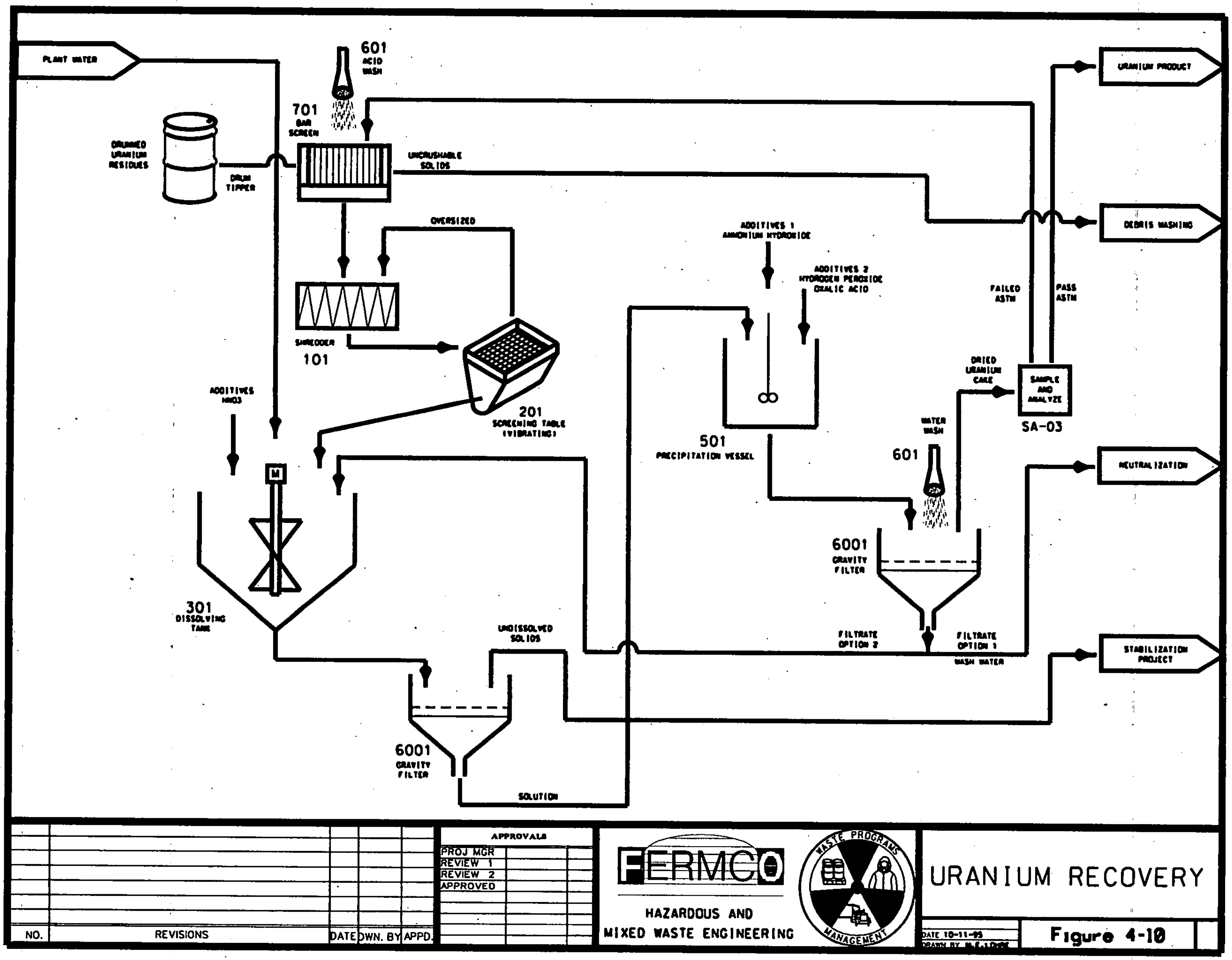

PLANT WATER
601
ACID WASH
701
BAR SCREEN
DRUMMED URANIUM RESIDUES
DRUM TIPPER
UNCRUSHABLE SOLIDS
OVERSIZED
SHREDDER
101
201
SCREENING TABLE (VIBRATING)
ADDITIVES HNO3
M
301
DISSOLVING TANK
UNDISSOLVED SOLIDS
6001
GRAVITY FILTER
SOLUTION
ADDITIVES 1 AMMONIUM HYDROXIDE
ADDITIVES 2 HYDROGEN PEROXIDE OXALIC ACID
501
PRECIPITATION VESSEL
WATER WASH
601
6001
GRAVITY FILTER
FILTRATE OPTION 2
FILTRATE OPTION 1
WASH WATER
DRIED URANIUM CAKE
SAMPLE AND ANALYZE
SA-03
FAILED ASTM
PASS ASTM
URANIUM PRODUCT
DEBRIS WASHING
NEUTRALIZATION
STABILIZATION PROJECT
NO.
REVISIONS
DATE
DWN. BY
APPD.
APPROVALS
PROJ MGR
REVIEW 1
REVIEW 2
APPROVED
FERMCO
HAZARDOUS AND
MIXED WASTE ENGINEERING
WASTE PROGRAMS MANAGEMENT
URANIUM RECOVERY
DATE 10-11-95
Figure 4-10

Figure 4-10

4.3.10 Mercury Amalgamation

Amalgamation is the treatment standard for liquid elemental mercury contaminated with radioactive materials. The treatment produces a leach resistant solidified waste form with reduced potential for emitting mercury vapors. Powdered reagents such as copper, zinc, tin, nickel, gold, or sulfur are mixed with liquid mercury to produce a metal alloy void of free elemental mercury. The metals may require chemical pretreatment with an acid to yield a quality alloy. Amalgamation works best when mercury is first separated from the matrix. Decontamination processes will be investigated for mercury batteries.

The current inventory of waste in the mercury waste category will be treated and consumed through mercury treatability studies described in Section 3.2. The studies are being performed by Nuclear Fuel Services, Inc., in Erwin, TN. Results of the studies will be distributed throughout the DOE complex to support complex wide needs for developing treatment for large mercury remediation projects (i.e., Y-12 in Oak Ridge, TN) and for treatment of future generated mercury waste at the FEMP. The advantage of using the FEMP mercury waste in the studies is that it provides a wide array of waste matrices packaged and available for immediate shipment and treatment. The matrices include water, debris (floor tile, piping, etc.) elemental mercury, mercury contaminated uranium scrap salts, mercury light tube and bulbs, and mercury batteries. Because the current inventory will be treated through the treatability study, a description of full scale treatment for mercury will not be provided.

4.4 SECONDARY WASTE TREATMENT PROCESS DESCRIPTION

Chemical treatment processing will result in the generation of secondary wastes. These wastes are by-products of primary treatment. This section will describe the general treatment processes for these secondary wastes. Whenever feasible, secondary wastes will be transferred to existing treatment processes for on-site treatment.

Secondary wastes generated from the primary treatment processes include waste waters, spent solvents, and solids with metal contamination. The secondary treatment processes will include liquid waste bulking through the Liquid Mixed Waste Project for disposition to the FEMP WWTF or TSCA Incinerator, and stabilization for metal contaminated solid wastes. Approved work plans for the Liquid Mixed Waste Project and Mixed Waste Stabilization Project are currently in place. The following sections provide descriptions for those treatment processes.

4.4.1 Stabilization

Many of the secondary waste streams generated during treatment processing will require stabilization prior to final disposition. Wastes which leach heavy metals will be stabilized to immobilize the hazardous constituents. Solids, sludges, and fines should meet organic LDRs prior to stabilization.

Chemical stabilization is a process by which wastes are treated to reduce the leachability of toxic heavy metals. A reagent is added that chemically reacts to transform the waste so the hazardous constituents are in a less mobile or toxic form. The use of cement-based reagents raise the pH to aid in precipitation and immobilization of heavy metal contaminants. Stabilization, with cement based materials, also results in a solidified product with improved handling and physical characteristics. Process equipment may include in-drum, batch and continuous mixers. The conceptual treatment process described is based on current implementation of the Mixed Waste Stabilization Project. An alternative treatment process may be employed, if necessary.

Initially, free liquids will be decanted from drummed waste. The remaining solids will be screened, sorted, and shredded as necessary. Secondary waste streams generated during Chemical Treatment processing may be conveyed directly to the stabilization mixer.

Next, water and additives will be blended in a pretreatment tank or container equipped with a mixer. Additives will be used to aid in the precipitation of metals prior to stabilization. Free liquids decanted earlier may be used as blending water.

Stabilization media (Portland cement), the waste, and blended additives will be conveyed to a stabilization vessel. Additional blending and stabilization may take place in the same tank or container. The mixture will be constantly agitated during the stabilization process to keep the waste, additives, and cement in suspension to assure the chemical reaction occurs. The result is a homogeneous product with less contaminant mobility and more structural integrity.

The solidified product will be sampled and conveyed to a container for curing. Following a predetermined curing period, the samples will be analyzed and results evaluated to determine if the waste meets LDR standards and disposal facility WAC. Material that is nonhazardous is eligible for disposal as LLRW. Material which is still regulated as mixed waste and meets LDR Standards must be disposed in a permitted mixed waste disposal facility. Material not meeting LDR will be reprocessed.

4.4.2 Waste Water Treatment Facility (WWTF)

The FEMP WWTF is eligible to receive and treat mixed aqueous waste streams that are contaminated with low concentrations of hazardous constituents. The WWTF can be used to treat contaminated waste waters and secondary wastes which meet specific criteria. The WWTF is capable of treating hazardous constituents in each characteristic waste stream added to the system. The WWTF is capable of removing volatile organic compounds, heavy metals, nitrates, fluorides and uranium through precipitation, filtration, ion exchange, activated carbon absorption, deactivation of ignitables, corrosives, reactives, and neutralization of acids/bases additions.

Waste streams identified as having a technology based standard other than deactivation cannot be treated in the WWTF. Prohibited wastes include; ignitable waste (D001) with total organic compounds (TOC) greater than ten percent (>10%), pesticides (D012-D017), and mercury greater than 260 mg/kg.

Each potential waste stream eligible for treatment through the WWTF will be evaluated to determine if the hazardous constituents can be treated by the WWTF, the rate at which waste will be added to the WWTF, if treatment of the waste will interfere with the normal operation of the WWTF or would impact NPDES discharge criteria, if aggregation is appropriate or if the waste can be discharged directly.

Use of the FEMP WWTF to treat aqueous waste streams from the Chemical Treatment Project will be implemented through the Liquid Mixed Waste Project. A Work Plan Addendum is being developed and will detail implementation. To facilitate treatment, these waste streams may be collected and bulked prior to processing through the FEMP WWTF.

The FEMP WWTF includes a land based unit, the Biosurge Lagoon, which is not permitted for treatment of hazardous waste. Wastes must be treated so that they are no longer hazardous prior to entering the Biosurge Lagoon. Additional treatment issues will be addressed in the addendum to the Liquid Mixed Waste Work Plan for use of the FEMP WWTF.

4.4.3 TSCA Incinerator

The Toxic Substance Control Act (TSCA) Incinerator in Oak Ridge, TN is a custom rotary kiln incinerator designed to destroy liquid PCB and RCRA hazardous wastes. The DOE-Oak Ridge K-25 Site has developed a Waste Acceptance Plan (WAP) for the TSCA Incinerator. The WAC for sending waste to the TSCA Incinerator is included in the WAP. Prior to sending waste to the TSCA Incinerator, the generator must ensure that the requirements of CERCLA Section 121 (d)(2)(c)(3) are met and EPA Region IV agrees that the incinerator is operating in compliance with applicable permits (i.e., RCRA, TSCA, CWA, CAA).

The FEMP will only send liquid waste to Oak Ridge for incineration. All liquid waste will meet the criteria for acceptance established in the TSCA Incinerator WAP. These criteria include:

- Characterizing the waste, including evaluation for physical form, analysis for specific chemical constituents, and a description of the radionuclide content
- The identified waste codes for an individual waste stream must be in the list of permitted waste codes in Table 4-2, "Summary of Waste Codes", and "P" and "U" Hazardous Waste Codes"
- Waste must follow WAP specified Sampling and Analysis (S&A) procedures
- Viscosity <5000 centipoise at 100 degrees Fahrenheit
- Suspended solids $<10\%$ by weight
- Freezing point <32 degrees Fahrenheit
- Boiling point >100 degrees Fahrenheit
- Chemical constituents $>1\%$ in the waste, evaluate for auto ignition <300 degrees Fahrenheit.
- Waste must be nonvolatile, such that it does not evaporate rapidly when opened. The waste may, however, contain volatile constituents.
- Waste must be non-reactive as defined by RCRA SW-846 Chapter 7, Section 7.3, "Reactivity".
- Generator must certify whether or not the waste contains any deactivated D002 waste. (Hazardous waste containing deactivated D002 will not carry the D002 code, however, additional analysis prior or subsequent to incineration is required).
- Appropriate Waste Acceptance Forms must be completed prior to shipment
- Waste must be analyzed for the following parameters:

<u>Physical parameters:</u>	ash content	flash point
	heating value	boiling point
	specific gravity	freezing point
	viscosity	number of phases
<u>Chemical parameters:</u>	total sulfur	total chloride
	total fluoride	metals

Use of the TSCA Incinerator to treat the secondary waste from the Chemical Treatment Project will be implemented through the Liquid Mixed Waste Project. If needed, an addendum to the Liquid Mixed Waste Work Plan will be prepared. To facilitate treatment and demonstration of waste acceptance, these waste streams will be bulked.

Subject waste will be bulked and transported to the TSCA Incinerator by truck. Incinerator Facility and Chemical Treatment Project technical personnel will evaluate the waste for acceptability and FEMP personnel will prepare the waste and necessary paperwork for shipment to Oak Ridge. Upon receipt, the shipment will be inspected, transported to the K-1435 TSCA Incinerator and incinerated.

TABLE 4-2
SUMMARY OF WASTE CODES
Accepted by TSCA Incinerator

Hazardous Waste	Hazard	EPA Hazardous Waste Codes
	Ignitable	D001
	Corrosive	D002
Arsenic	Toxic	D004
Barium	Toxic	D005
Cadmium	Toxic	D006
Chromium	Toxic	D007
Lead, Spent Batteries	Toxic	D008
Mercury	Toxic	D009
Selenium	Toxic	D010
Silver	Toxic	D011
Endrin	Toxic	D012
Lindane	Toxic	D013
Methoxychlor	Toxic	D014
Toxaphene	Toxic	D015
2,4-D	Toxic	D016
2,4, 5-TP	Toxic	D017
Benzene	Toxic	D018
Carbon Tetrachloride	Toxic	D019
Chlordane	Toxic	D020
Chlorobenzene	Toxic	D021
Chloroform	Toxic	D022
o-Cresol	Toxic	D023
m-Cresol	Toxic	D024
p-Cresol	Toxic	D025
Cresol (specific isomer is unknown)	Toxic	D026
1,4-Dichlorobenzene	Toxic	D027
1,2-Dichloroethane	Toxic	D028
1,1-Dichloroethylene	Toxic	D029
2,4-Dinitrotoluene	Toxic	D030
Heptachlor	Toxic	D031
Hexachlorobenzene	Toxic	D032
Hexachlorobutadiene	Toxic	D033

TABLE 4-2
SUMMARY OF WASTE CODES
Accepted by TSCA Incinerator

Hazardous Waste	Hazard	EPA Hazardous Waste Codes
Hexachloroethane	Toxic	D034
Methyl Ethyl Ketone	Toxic	D035
Nitrobenzene	Toxic	D036
Pentachlorophenol	Toxic	D037
Pyridine	Toxic	D038
Tetrachloroethylene	Toxic	D039
Trichloroethylene	Toxic	D040
2,4,5-Trichlorophenol	Toxic	D041
2,4,6-Trichlorophenol	Toxic	D042
Vinyl Chloride	Toxic	D043
Spent Halogenated Solvents, Sludges from the Recovery Of Specific Solvents	Toxic	F001 and F002
Spent Non-Halogenated Solvents, Sludges from the Recovery of Specific Solvents	Ignitable	F003
Spent Non-Halogenated Solvents, Sludges from the Recovery of Specific Solvents	Toxic	F004
Spent Non-Halogenated Solvents sludges from the Recovery of Specific Solvents	Ignitable, Toxic	F005
Waste Water Treatment Sludges from Electroplating Operations except from Specific Processes	Toxic	F006
Plating Bath Residues from the Bottom of Plating Baths from Electroplating Operations where Cyanides are used in the Process	Reactive, Toxic	F008

TABLE 4-2
SUMMARY OF WASTE CODES ACCEPTED BY TSCA INCINERATOR
"P" and "U" Hazardous Waste Codes

The basis for hazardous designation for all EPA Hazardous Waste Codes is derived from Tennessee Rule Chapter 1200-1-11-.02. The name of the substance is also found in Tennessee Rule Chapter 1200-1-11-.02.

"P" Hazardous Waste Codes

P001	P013	P027	P041	P056	P069	P084	P099	P113
P002	P014	P028	P042	P057	P070	P085	P101	P114
P003	P015	P029	P043	P058	P071	P087	P102	P115
P004	P016	P030	P044	P059	P072	P088	P103	P116
P005	P017	P031	P045	P060	P073	P089	P104	P118
P006	P018	P033	P046	P062	P074	P092	P105	P119
P007	P020	P034	P047	P063	P075	P093	P106	P120
P008	P021	P036	P048	P064	P076	P094	P108	P121
P009	P022	P037	P049	P065	P077	P095	P109	P122
P010	P023	P038	P050	P066	P078	P096	P110	P123
P011	P024	P039	P051	P067	P081	P097	P111	
P012	P026	P040	P054	P068	P082	P098	P112	

TABLE 4-2
SUMMARY OF WASTE CODES ACCEPTED BY TSCA INCINERATOR
"P" and "U" Hazardous Waste Codes

The basis for hazardous designation for all EPA Hazardous Waste Codes is derived from Tennessee Rule Chapter 1200-1-11-.02. The name of the substance is also found in Tennessee Rule Chapter 1200-1-11-.02.

"U" Hazardous Waste Codes

U001	U028	U056	U083	U111	U137	U164	U191	U221
U002	U029	U057	U084	U112	U138	U165	U192	U222
U003	U030	U058	U085	U113	U140	U166	U193	U223
U004	U031	U059	U086	U114	U141	U167	U194	U225
U005	U032	U060	U087	U115	U142	U168	U196	U226
U006	U033	U061	U088	U116	U143	U169	U197	U227
U007	U034	U062	U089	U117	U144	U170	U200	U228
U008	U035	U063	U090	U118	U145	U171	U201	U234
U009	U036	U064	U091	U119	U146	U172	U202	U235
U010	U037	U066	U092	U120	U147	U173	U203	U236
U011	U038	U067	U093	U121	U148	U174	U204	U237
U012	U039	U068	U094	U122	U149	U176	U205	U238
U014	U041	U069	U095	U123	U150	U177	U206	U239
U015	U042	U070	U096	U124	U151	U178	U207	U240
U016	U043	U071	U097	U125	U152	U179	U208	U243
U017	U044	U072	U098	U126	U153	U180	U209	U244
U018	U045	U073	U099	U127	U154	U181	U210	U246
U019	U046	U074	U101	U128	U155	U182	U211	U247
U020	U047	U075	U102	U129	U156	U183	U213	U248
U021	U048	U076	U103	U130	U157	U184	U214	U249
U022	U049	U077	U105	U131	U158	U185	U215	U328
U023	U050	U078	U106	U132	U159	U186	U216	U353
U024	U051	U079	U107	U133	U160	U187	U217	U359
U025	U052	U080	U108	U134	U161	U188	U218	
U026	U053	U081	U109	U135	U162	U189	U219	
U027	U055	U082	U110	U136	U163	U190	U220	

4.5 PRODUCTION PROCESS CONTROL

Positive control of the production process by which waste is treated is a critical part of each treatment process. A detailed presentation of the strategy and methods of production process control will be developed and presented in the technology specific work plan for each treatment process. The presentation will describe how treatment processes will be controlled to assure that final waste forms produced will meet LDR standards and waste acceptance criteria for designated disposal facilities. The process control plan will also provide how documentation is maintained for each container of waste received for treatment.

Activities associated with each treatment process will be monitored and necessary corrective actions taken to assure that activities are proceeding according to each technology specific work plan. Implementation of process control involves two major activities. The first is measuring results of controlled treatment activities. The second is identifying deviations from planned performance (i.e., out of control condition) and taking actions to make necessary corrections.

Treatability studies will be utilized to provide some of the parameters controlled in the treatment process. These include quantity of reagents, treatment unit retention time, and criteria for incoming waste. If operating experience indicates that adjustments to the treatment process are required, additional optimization testing may be performed.

Real-time testing may be performed to confirm full scale treatment operations conform to process specifications. Test parameters will be specified in the process control plan for each treatment process. Real-time testing would aid in providing immediate feedback enabling adjustments to be made to the process prior to waste processing. This will reduce the need to reprocess waste, and minimize down time awaiting results from laboratory analysis.

Process feedback sampling and analysis may be used to provide quick feedback on treated waste. This quick and simple sampling and analysis is performed as a means to screen the success of the treatment process. If initial results indicate success, additional sampling and analysis will be performed for LDR standards, waste characterization, and disposal facility WAC. All sampling and analysis will be performed per an approved sampling and analysis plan (SAP) provided for each technology specific work plan. SAP requirements are provided in Section 9.0.

Maintaining project documentation is critical to maintaining the identity of waste streams as they pass through various treatment processes. Primary documents will include the Operational Logs and Chain-of-Custody Forms for waste sampling. The Operational Logs will be completed to document daily events in the process area including incoming waste, process waste, and other general observations. All process changes must be documented and include the basis for change, the change that was made, and results of the changes.

4.6 ENVIRONMENTAL MANAGEMENT

This section describes environmental management measures for this project. The following discussion focuses on minimizing waste generation, managing primary and secondary process wastes, and protecting the environment.

4.6.1 Waste Minimization

Waste minimization is an important cost saving activity to all projects. Waste may be minimized through efficient operation of a treatment process, use of available surplus chemicals and waste to treat wastes, and preventing contamination of material, equipment, and site facilities. Incorporating site waste minimization controls and procedures will be handled in conjunction with Waste Minimization.

4.6.1.1 Waste Minimization by Efficient Operation

The project team will minimize waste generation through efficient operation of each treatment process. Tight control of material and reagent inventories in the process area will minimize surplus materials or reagents from being left in the process area at the conclusion of the project. Engineering each process to maximize waste loading will provide additional minimization of the final treated waste form. Optimization studies may be performed in the laboratory to determine the maximum waste loading without compromising the integrity of the final waste form.

4.6.1.2 Waste Minimization by Use of Surplus Chemicals

Before chemical reagents are purchased and brought on to the FEMP site, surplus chemicals and waste currently in storage on the site will be evaluated for use in the treatment processes. Existing site inventories of excess chemicals have been identified and include sodium sulfide, alkaline cleaners, soda ash, potassium permanganate, potassium carbonate, ferric hydroxide, ammonium bicarbonate and sodium hydroxide. A search of the site chemical inventory will be conducted to identify additional surplus chemicals (e.g., ferrous sulfate, sodium sulfate, etc.) that may be available prior to start up of treatment processes. This chemical search will be performed with the assistance of Waste Minimization.

4.6.1.3 Waste Minimization by Prevention of Material or Equipment Contamination

All items used in the radiological control area have the potential to become radioactively contaminated, therefore, the project team must minimize materials, and equipment brought into the project control area. An aggressive pollution prevention program will be implemented by project personnel to prevent material and equipment contamination associated with the treatment process.

Reagents used in the treatment processes will be controlled in a manner to prevent contamination allowing excess reagents to be removed from the FEMP upon completion of operations. Consumable supplies brought onto the site will enter through FEMP receiving, where disposable packaging will be removed and replaced with site-reusable packaging. This prevents disposable packaging from becoming low level radioactive waste.

Wherever possible, project equipment will be covered in plastic sheeting to prevent contamination during process operations. This precaution will help to minimize surface contamination and costs associated with decontamination activities. These temporary coverings greatly limit exposure of equipment and container exterior surfaces to contamination and expedites Radiological Control clearance for release from the FEMP. Contaminated equipment will be decontaminated to the extent possible to meet free release limits.

4.6.1.4 Waste Minimization by Prevention of Building or Area Contamination

The potential treatment process area is likely to have fixed contamination from past uranium processing. It is unlikely the mixed waste treatment process will result in significant additional contamination of the process area. In areas where spills or leaks of liquid waste to the building floor could occur, drip pans and Herculite™, or equivalent floor covering, will be used to provide a contamination barrier.

4.6.2 Prevention of Environmental Media Pollution

Potential discharges of pollutants to soil, surface water, groundwater, storm sewer systems, and the atmosphere will be minimized to the extent practical. Section 6.0 of this work plan describes the permitting and regulatory issues regarding emissions to the environment.

To reduce the risk of discharge to soil and groundwater, project activities will be performed inside to the extent possible. The process area will be surveyed to identify any potential points of communication between the building floor and the ground outside the building or the storm sewer system. Bulk liquid storage areas inside the exclusion zone will be provided with temporary secondary containment structures capable of containing the contents of the largest tank inside the containment, with an ample margin of safety.

For water pollution prevention, every effort will be made to close the water balance by reusing or recycling water generated in the treatment processes. Water generated during treatment operations will be accumulated, reused, or treated for recycling. If excess water is generated, it will be evaluated for discharge to the FEMP WWTF. Waste water unacceptable for discharge through this system will be evaluated for further disposition (i.e., TSCA Incinerator).

Air contaminant sources will be evaluated to determine best available technology for controlling air emissions. Air emissions from treatment processes may be minimized by using dust suppression sprays at fugitive dust emission points.

Negative pressure dust and fume collection systems consisting of hoods, hoses, and ducts may be used to draw air from fugitive dust zones and discharge it to the atmosphere outside the building via a prefilter and a high efficiency particulate air (HEPA) filter. Permitting and regulatory issues relating to air emissions are presented in Section 6.0 of this work plan. Additional information on air emissions will be included in each technology specific work plan.

4.6.3 Spill Prevention and Emergency Response

Care will be exercised at all times to prevent spills from occurring inside or outside the process area. When spills or leaks do occur, prompt response action will be taken by the project team to contain and clean-up the spill, with all recovered materials being properly managed as recyclable materials or as wastes. Spill response will be in accordance with the following FEMP site plans and procedures:

FEMP RCRA Contingency Plan

FMPC Spill Prevention Control & Countermeasure Plan (PL-2194)

Spill Incident Reporting and Clean Up (EP-0004)

Spills will be reported through the project organization to the Project Manager and Assistant Emergency Duty Officer (AEDO).

Project team personnel will be the first responders for all spills or releases within the exclusion zone. Spill kits, containing dry absorbent granules, pads and booms, will be located in the exclusion zone close to areas of potential spills or leaks. In the event of a large spill, or a spill that causes a condition immediately dangerous to life or health (IDLH), project team personnel will evacuate the exclusion zone, notify the Fernald Emergency Response Team, and stay outside the exclusion zone until the condition is resolved. Portable fire extinguishers will be in accessible locations for emergency response.

4.6.4 Waste Management and Disposal

Treatment processes for the Chemical Treatment Project will process primary and secondary wastes. Primary wastes include original wastes entering the treatment process, and treated waste after processing. Secondary wastes include wash and decontamination water, used personal protective equipment, RCRA empty drums, miscellaneous construction materials, and other waste generated as a result of treatment of the primary wastes.

As discussed in Section 4.6.1, generation of secondary wastes will be minimized to the extent practical. Generation of secondary waste will be tracked and linked to the primary waste from which it derived. Whenever possible, efforts will be made to prevent contamination of solid waste materials with mixed waste constituents. Decontamination and recertification of PPE items such as respirators, outer boots, and gloves will be used to the extent practical. Wastes generated by a vendor which must be dispositioned by the FEMP will be properly labeled, marked, and transferred to FEMP custody. The FEMP will manage project waste under site procedure EW-0006, *Management of Excess Soil, Debris and Waste from a Project*. RCRA empty drums will be sent to the on-site drum crushing facility.

The project team will manage all waste materials in accordance with ARARs, site procedures and plans established for each treatment process. Compliance with ARARs is discussed in Section 6.0.

4.6.4.1 Facility and Container Inspections

Inspections of waste containers, holding tanks, and equipment in the process area will be conducted and documented daily as specified in 40 CFR 265.15(d). Inspections in container storage or staging areas includes, but will not be limited to, inspection of containers for leaks, damage, indications of over pressure, loose or illegible labels, aisle spacing, and waste compatibility. Also, the presence and accessibility of adequate quantities of emergency response equipment will be verified. Inspections in the area where waste materials are held in tanks, will include an inspection of the secondary containment for evidence of leakage from the tank.

Process equipment will be inspected for mechanical or electrical conditions which could cause an accident, or render the equipment inoperable if not corrected. If such a condition is found, the equipment will be immediately tagged out of service and maintenance or repairs initiated. Before maintenance or repair work can take place, the equipment must be de-energized and locked out by the person performing the work, so that it cannot be reenergized until the employee removes their lock.

4.6.5 Materials Management

Non-waste materials such as reagents, equipment spare parts, and consumable supplies will be managed safely to prevent processing delays due to shortages of critical supplies. Consumable supplies will be vendor-supplied materials necessary to make the production process function. These include fuels, equipment maintenance supplies (e.g., lubricants, hydraulic fluids, filters, etc.), hand tools, spare parts, quality control test supplies, housekeeping supplies, emergency or spill response supplies, personal protective equipment, and office supplies.

Reagents and supplies are to be received, handled, processed, and stored in accordance with applicable procedures. Records of supplies will be made and receipts kept. Records will show the date received, quantity received, condition when received, and location the reagent or supplies are to be stored. Operations will be inspected to identify improvement opportunities for materials handling. Bulk materials should be moved pneumatically, with pallets, or other carriers whenever possible. Procedures for storing materials on-site will be followed. Regular, periodic inspection of both the storage area and inventories will be made.

Material control for this project will be the method by which all materials, supplies, and purchased parts will be obtained and stored until they are used, and which inventories are controlled to prevent shortages. Replenishment stocks for each item will be based on required lead time, supplier reliability, value of materials, cost of storage, and risks of deterioration. Documentation concerning the quality of materials used in the process will be retained in the project files. Typically, this documentation includes:

- Manufacturer and lot number for calibration standards.
- Certificates of analyses for chemicals used in decontamination.
- Certificates of decontamination furnished by the equipment manufacturer.
- Material certificates and lot numbers for construction materials.

A check of materials and supplies in stock will be routinely made. Project personnel will determine when the reorder point is reached for bulk consumable items.

4.7 FACILITIES AND EQUIPMENT

This section describes the facilities and equipment that will be used to treat mixed waste. Water, electricity, local phone service, and shelter for the waste treatment equipment is available at the FEMP. All tools, vehicles, and equipment will be inspected for radioactive contamination prior to initial entry and upon removal from the designated processing area as required.

4.7.1 Processing Facilities

The FEMP is located near Fernald, Ohio, approximately 20 miles northwest of downtown Cincinnati as shown in Figure 4-11. The total area of the site is 1,050 acres of which 850 acres are in Hamilton County and 200 acres in Butler County. Figure 4-12 is an illustration of the FEMP site. Waste processing activities for each waste category will likely be conducted in Plant 6. Waste segregation will likely be performed in Building 71.

4.7.1.1 Process Area

Space requirements of the work area will be a function of available space, operational requirements, critical equipment dimensions, maneuvering space, material storage, equipment space, and need of each treatment process. The work location will be specified in each technology specific work plan. The following specific work/activity stations shown inside the exclusion zone may include:

- Buffer Zone (Delivery of incoming waste drums)
- Incoming Waste Staging Area
- PreTreatment Units
- Primary Treatment Units
- Secondary Treatment Units
- High Efficiency Particulate Air (HEPA) Filter Units

- Empty Drum Staging Area
- Reagent Makeup Area
- Treated Waste Staging Area

The portion of the building used for the process area will have appropriate overhead clearance. The floor will safely support vehicles and equipment in the area. Secondary containment pans and basins, and Herculite™ floor coverings will be used in locations where a high potential exists for liquid spills or leaks. Otherwise, the floors will remain uncovered. Appropriate housekeeping measures will be provided to prevent accumulation of contaminants on the process area floor.

4.7.1.2 Incoming Waste Staging Area

The incoming waste staging area will be located inside the process area, inside the exclusion zone, or in close proximity to the process area. Appropriate containment will be provided to control spills or leaks from the containers.

4.7.1.3 Reagent Makeup Area

The reagent makeup area will be located inside the process area or within close proximity of the process area. This is the area where treatment reagents will be prepared. Reagents may be a dry solid, liquid, or gaseous. Reagents may include, but are not limited to cements, industrial detergents, surfactants, decontamination fluids, inorganic sulfates and sulfides, lime, sodium hydroxide or caustic for neutralization, and nitric acid.

4.7.1.4 Exclusion Zone

The exclusion zone is the area that will be restricted to project personnel, authorized FEMP personnel and visitors specifically authorized and qualified to enter. Qualifications for entry will be established in accordance with the Health and Safety Plan developed for the specific treatment process. Personnel entering the exclusion zone must be properly dressed and must comply with all other posted entry requirements.

4.7.1.5 Emission Control and Off-Gas Operations

Air contaminant sources will be evaluated to determine best available technology requirements on a case-by-case basis. Radiological sources control will consist of HEPA filtration. At each location where fugitive dust generation is likely, the dust zone will be hooded, and a pneumatic intake will draw a flow of air sufficient to provide adequate velocity to capture dust, gases and vapors that may be generated by processing activities. Each intake and its downstream duct network will be vented to a properly sized HEPA filter which will exhaust to atmosphere outside the building. Each HEPA unit will also be equipped with a prefilter.

4.7.2 Utilities

Performance of treatment operations may require the following utilities:

- Electric Power
- Potable Water
- Compressed Air
- Sewer Connection
- Lighting
- HVAC
- Supplied Breathing Air

Requirements of these utilities will be specified in the technology specific work plan for each treatment process.

4.7.3 Services

In addition to the utilities listed above, services, equipment and materials are available for use at the FEMP. These include, but are not restricted to, the following:

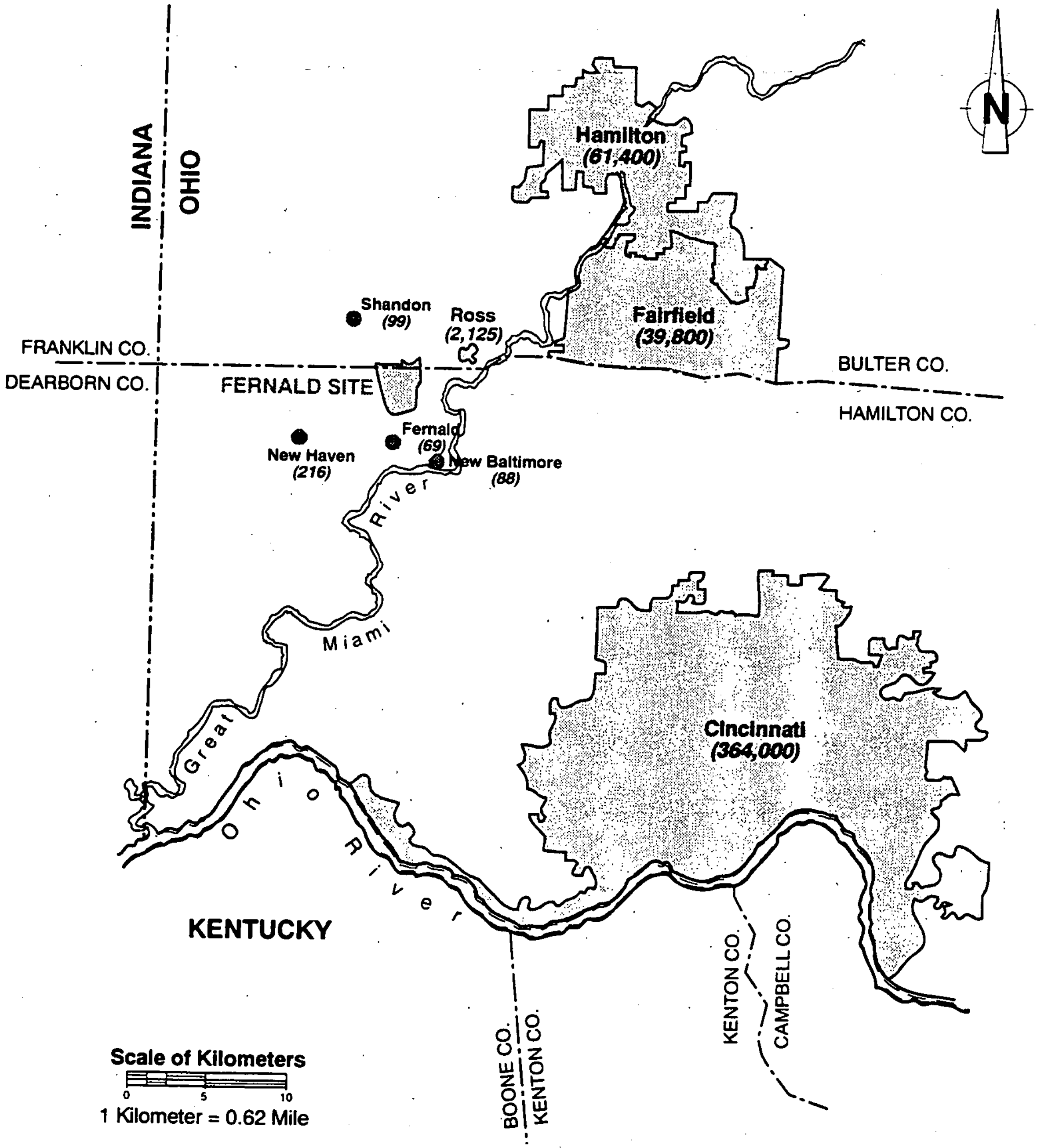
- An inside process area.
- Laboratory analytical services for LDR and waste acceptance analyses for comparison against Regulatory Levels and disposal facility WAC criteria.
- Specification containers for packaging treated waste for disposal.
- On-site transportation services for incoming and outgoing waste containers.
- Removal and disposal of RCRA empty containers.
- Radiological Control and industrial hygiene monitoring support.

4.7.4 Processing Equipment

Processing equipment used for treating mixed waste will be listed in each technology specific work plan. Equipment specifications will be based on the equipment design basis.

4.7.4.1 Equipment Maintenance

Maintenance will be performed on all equipment as needed to maintain ongoing process operations. Routine maintenance, such as lubrication and cleaning, is performed regularly by the operating crew members and in accordance with manufacturers instructions. For major corrective maintenance, a mechanic (other than a crew member) may be brought in. Every attempt is made to anticipate the need for maintenance and repair.



LEGEND

- ● Population in parenthesis estimated in 1989
- ▭ Population in parenthesis from 1990 U.S. Census Figures

Figure 4-11
FEMP Location Map

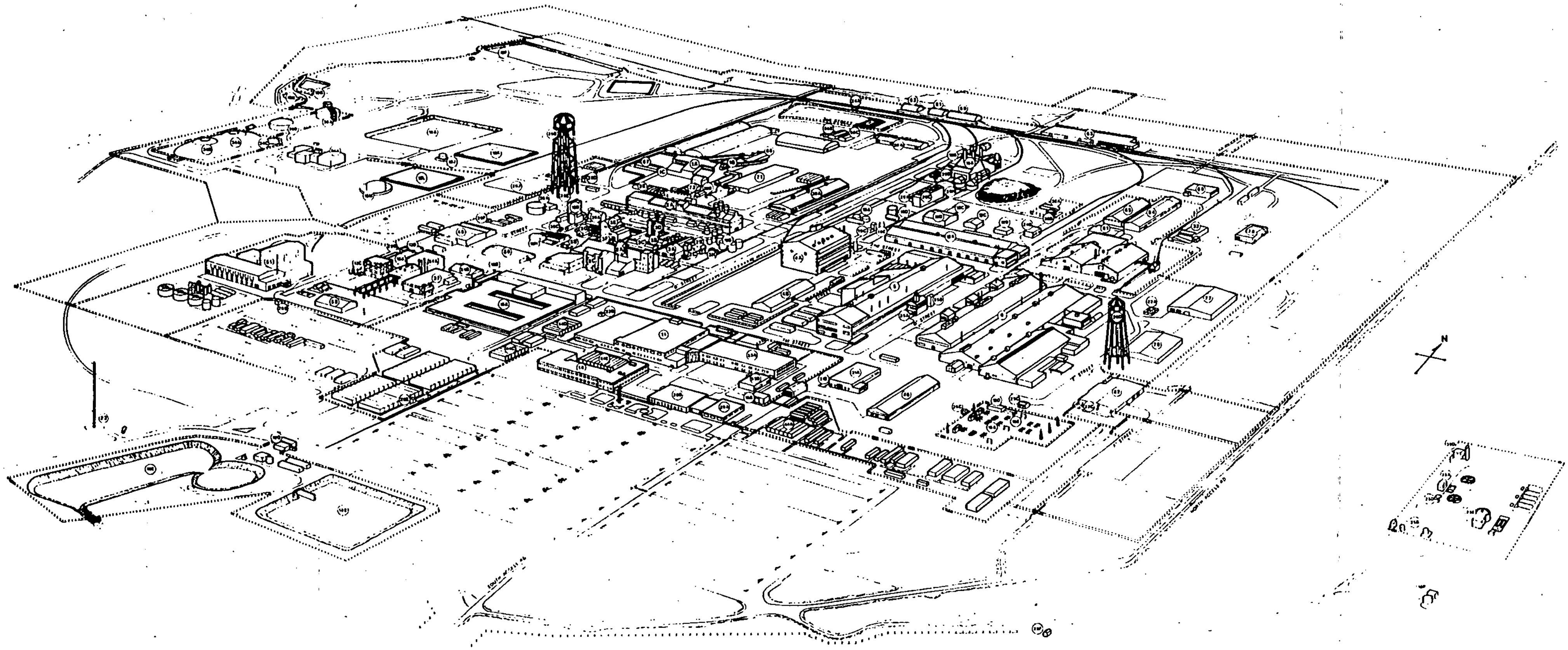


Figure 4-12
FEMP Site Map

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4.7.5 Equipment Mobilization

Mobilization activities include utility connections, drainage, warehousing, office area, laydown and storage areas, parking and other considerations required to manage the project. Heavy equipment will be transported, off-loaded, and erected. Project materials and supplies will be staged in or near the process area. Fire protection, first aid, and medical services for the vendor will be coordinated with the FEMP. Other mobilization considerations include communications, document reproduction, general security, building maintenance, office setup, reagent supply, and building preparation activities.

The potential process area will likely have substantial fixed floor contamination, which is subject to future decontamination and decommissioning requirements. Therefore, it may not be necessary to protect the floor from radiological contamination. Floor coverings will be used in areas around equipment or processes where a potential of liquid spills exists. Where floor coverings are required, Herculite™, or equal, polymer sheeting will be used. Any joints in the floor covering will be overlapped and sealed with Herculite™ bonding compound. Herculite™ may also be used as a tenting material in locations where barrier control of air exchange is required. Additional detail on secondary containment will be provided on a case-by-case basis for each technology specific work plan.

4.8 PROJECT SCHEDULE

A master schedule showing approximate order and time frame of each treatment process in the Chemical Treatment Project is provided in Figure 4-13. A detailed schedule for each treatment process will be provided in the technology specific work plan. The master schedule provides a logic sequence of treatment process implementation based primarily on the treatment trains introduced in the STP. As the project progresses, need may arise to modify the precise order of treatment process implementation. Modification may include altering the sequence of the treatment process implementation, splitting out portions from a treatment process, and performing some processes concurrently. For example, decontamination of lead solids may be performed during waste segregation operations. This is contingent upon the availability of funding, space, and resources.

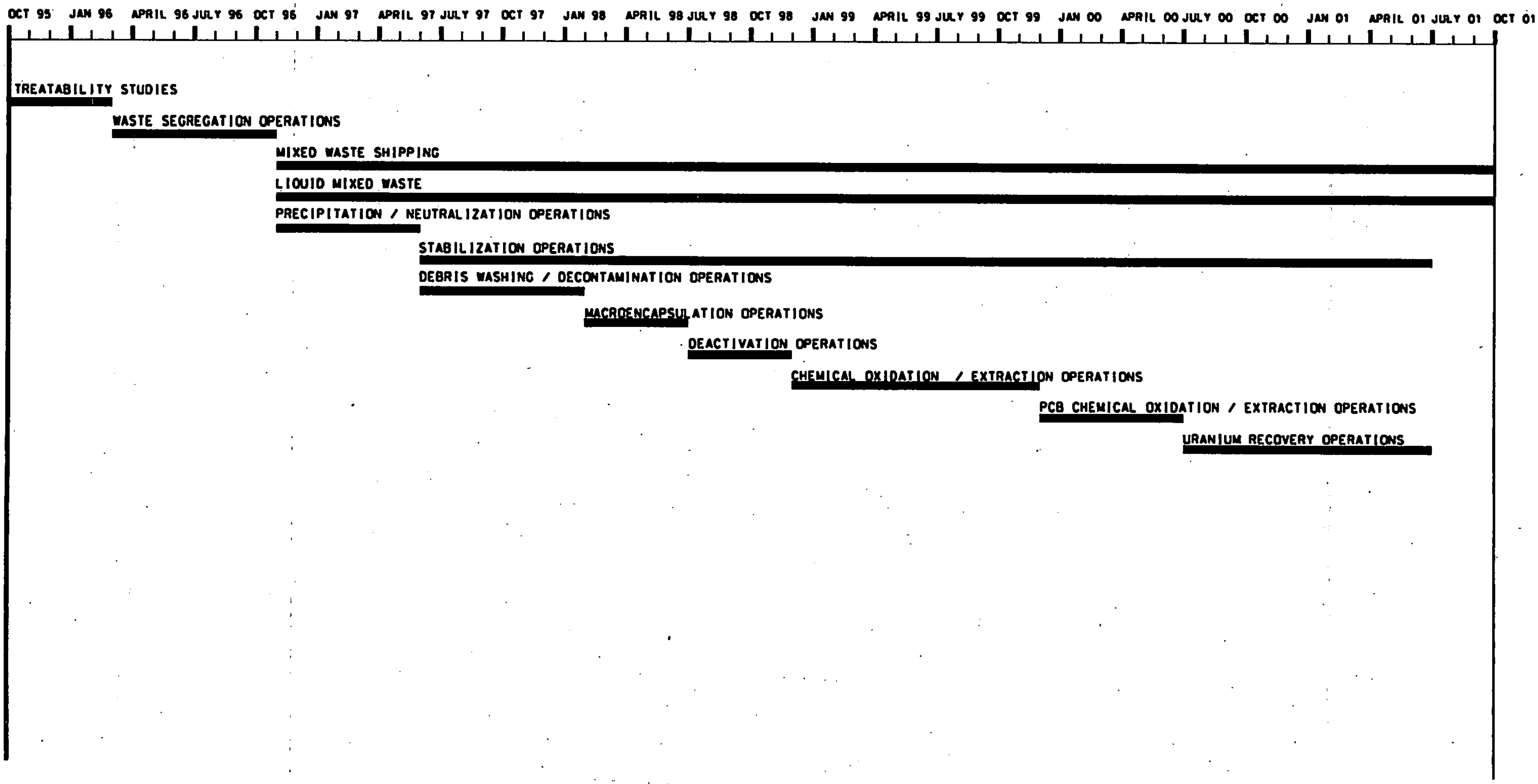

Figure 4-13
Chemical Treatment Project Schedule

4.9 DECONTAMINATION ACTIVITIES

Decontamination activities will be an integral part of this project. The primary method of decontamination during operations will be performing surface wash and rinse of nonporous items using a cleaning solution, followed by a clean water rinse. This method will be applied to decontaminate equipment and tools. These methods will also be used for area cleanup and housekeeping at the end of each shift. Recovered wash and rinse solutions will be collected and evaluated for disposition.

At the end of the project, the process area and all reusable equipment must be decontaminated. Dry vacuum, solution flush, triple-rinse, and surface wipe procedures will be used as appropriate in final decontamination of the equipment and process area. Accumulated decontamination waters will be held pending waste characterization. Decontamination activities shall be performed in compliance with DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* and FEMP site procedure RP-0009, *Radiological Requirements for the Release of Materials at the Fernald Environmental Management Project.*

4.9.1 Decontamination of Equipment Prior to Use

New equipment is considered free of contamination from hazardous or radioactive waste. No survey or measurements will be made unless specifically requested. Before any previously used equipment is used on the project, it must be surveyed for contamination and decontaminated, if necessary to protect against cross contamination. Contaminated equipment will be surveyed to determine and document the extent of contamination. Additional information is required before contaminated equipment may be brought onto the site. This includes the radioactive isotope, whether the contamination is fixed or removable, source or location of contamination, and level of contamination.

4.9.2 Decontamination for Routine Good Housekeeping

FEMP Radiological Control technicians make routine surveys of fixed or removable contamination in the facility. If removable contaminants are detected on floors or work surfaces in the exclusion or contamination reduction zones which exceed posted values, or if removable contaminant levels exceed those posted in the support zone, then the surfaces will be promptly decontaminated as described in Section 4.9.

4.9.3 Decontamination of Reusable Equipment and Process Area Post Processing

For purposes of this work plan, all process equipment is considered to be reusable under Ohio EPA Closure Plan Review Guidance for RCRA Facilities. After completion of waste processing, reusable equipment which has become contaminated with waste constituents shall be decontaminated. Decontamination will consist of a triple rinse to remove contamination. The rinsate will be sampled and analyzed, drummed, characterized and evaluated for final disposition. Reusable equipment will be surveyed for radiological contamination by FEMP Radiological

Control for free release. If equipment requires further decontamination to meet free release criteria, it will be steam cleaned, pressure washed or scrubbed, prior to resurveying.

The triple rinse process will be considered complete decontamination of reusable equipment for the purposes of RCRA in accordance with OEPA Closure Plan Review Guidance. Decontamination waters will be bulked for storage pending characterization and evaluation for treatment through the FEMP WWTF.

Wipe methods may also be used to enhance the effectiveness of decontamination. Drop cloths used during decontamination activities will be rolled to the inside and taped for reuse. Visual floor contamination will be removed by the same wash and rinse methods, except that the wash and rinse solutions will be collected using HEPA wet-vacs. FEMP Radiological Control technicians will confirm that the process operations have not significantly increased fixed and removable contamination levels by repeating the measurements made in the baseline survey. If contamination exceeding baseline levels occurs, FEMP Radiological Control personnel will specify further decontamination.

Equipment that cannot be decontaminated can be released to DOE, NRC, or an agreement state-licensed facility. Contaminated equipment intended for further use in the processing of mixed or radioactive waste does not require decontamination to limits for unrestricted use. Contaminated equipment is restricted to use only in the treatment of mixed or radioactive wastes. Release of any equipment for unrestricted use will be considered on a case-by-case basis at the time it is proposed for release.

4.9.4 Equipment Demobilization

Vendor demobilization activities include completion of the following checklist items. This is prior to leaving the FEMP Site and after decontamination.

- Empty and clean out lockers.
- Return FEMP furnished radio (if applicable).
- Return FEMP radio pass (if applicable).
- Sign medical termination form.
- Leave exit urine sample.
- Return TLD.
- Fill out request for final dosimetry reading.
- Take an exit INVIVO.
- Return identification badge.
- Provide forwarding address.
- Provide FEMP with turnover debriefing information.

5.0 WASTE DISPOSITION

This section identifies disposal options, waste types qualifying for disposal, and establishes general requirements for waste disposition. The FEMP has identified several categories of mixed waste requiring treatment and disposal. The goal of treatment is to meet LDR standards and disposal facility WAC for the waste to qualify for direct disposal. Due to the nature of contaminants, waste matrices, and technologies employed, not all waste will qualify for disposal at the same facility. Sections 5.1 through 5.2 will discuss the different disposal facilities and requirements of each.

All waste will be sampled and analyzed in accordance with the "FEMP Containerized Waste Sampling and Analysis Plan, Rev. 1", and SW-846. All sampling and analysis will be conducted in accordance with the FEMP Site-Wide CERCLA Quality Assurance Project Plan (SCQ) and project-specific sampling and analysis plan(s) developed for each treatment process. These plans will be developed to meet characterization and disposal facility WAC.

5.1 NEVADA TEST SITE (NTS)

Disposal at NTS is reserved for low level radioactive waste (LLRW). The Chemical Treatment Project will treat radioactively contaminated characteristic hazardous waste which, after treatment, will no longer be hazardous waste. Following treatment, radioactive waste meeting LDR, and is not a listed waste, and meets NVO-325, (Rev 1), <u>Nevada Test Site (NTS) Defense Waste Acceptance Criteria, Certification, and Transfer Requirements</u> will be sent to NTS for final disposition. Also, hazardous debris washed to a clean-debris-surface may be included as waste scheduled for disposal at NTS. NTS must review the project plans and procedures before approval to ship treated low-level waste.

Waste Characterization personnel will determine if the treated waste meets the requirements of the NTS WAC. If the waste meets the NTS WAC, then it will be prepared for shipment to NTS. If the waste does not meet the NTS WAC, the waste will be reprocessed until NTS's WAC is met. If after reprocessing the waste still exceeds NTS WAC, then the waste will be evaluated for alternative disposition.

Treated waste will be containerized and transported to NTS by truck. Waste Certification personnel will certify the waste for shipment to NTS and FEMP personnel will prepare the necessary paperwork for shipment to NTS. Once received at NTS, the containers of waste will be placed in-ground with other containers, following a grid system and buried.

5.2 ENVIROCARE OF UTAH (ENVIROCARE)

Envirocare is capable of accepting Naturally Occurring Radioactive Material (NORM), LLRW, 11e.(2), and mixed radioactive/RCRA hazardous wastes for disposal. Acceptable materials include contaminated soil, process waste, building debris, PPE, and other solid-phase wastes. Mixed waste which exceeds NTS WAC, but meets LDRs after processing, will be shipped to Envirocare for disposal. Also, mixed waste which has been macroencapsulated will qualify for disposal at Envirocare. As part of the EPA's LDR program, the agency promulgated universal treatment standards for wastes. These standards must be met prior to land disposal.. For radioactive wastes mixed with the newly listed or identified wastes, or soil and debris contaminated with such mixed waste (40 CFR 268.38), the compliance date is September 19, 1996. Newly identified organic TC wastes include EPA waste codes D018 through D043. Treated mixed waste which meets concentration and/or technology based treatment standards and meets criteria established in Envirocare's *"Material Acceptance Process Manual"*, will be sent to Envirocare for final disposition. Also included as waste acceptable for disposition at Envirocare is low level contaminated asbestos waste. Envirocare must review the Mixed Waste Profile Record, Physical Properties Record, and Radiological Evaluation forms before approval to ship the treated low-level mixed waste is given. All sampling and analysis will be conducted in accordance with the FEMP Site-Wide CERCLA Quality Assurance Project Plan (SCQ).

Waste Characterization and Chemical Treatment Project technical personnel will determine if the treated waste meets the requirements of Envirocare's WAC. If the waste meets the Envirocare WAC, then it will be prepared for shipment to Envirocare. If the waste does not meet the Envirocare WAC, the waste will be reprocessed until Envirocare's WAC is met. If after reprocessing the waste still exceeds Envirocare's WAC, then the waste will be set aside for evaluation to determine proper disposition.

Treated waste will be containerized and transported to Envirocare via truck. Chemical Treatment Project technical personnel will evaluate the waste for acceptability at Envirocare. The waste will be prepared with the necessary paperwork for shipment to Envirocare. Once received at Envirocare, the containers of waste will be disposed in the appropriate cell. Once design capacity is reached, waste in the completed cell is entombed in a seven-foot clay radon barrier, a rock filter zone, and a coarse rock erosion barrier.

5.3 RECYCLING SERVICES

Several different waste streams have been identified as recyclable materials. These materials include elemental lead, Ni-Cd batteries, and uranium residues. Decontamination may be required for each of these waste streams prior to entering the recycling process. Following treatment, each waste stream will be prepared for shipment to an approved off-site vendor for recycle.

5.3.1 Elemental Lead

Currently, the FEMP has a contract with a commercial battery smelting facility to provide lead acid battery recycling services. This recycling facility has the ability, to manage elemental lead. Additional recycling options will also be evaluated. These include direct shipment of contaminated lead to a permitted treatment facility, and use of alternative recycling facilities.

The FEMP ships batteries to the recycling facility banded onto wooden pallets. The complete shipping package, batteries, pallets banding and all, is crushed and burned. Lead is the only component that melts and resolidifies. Lead is then recovered and sent to a foundry. The services may be expanded to include elemental lead in the recycling service.

Prior to sending material for recycle, treatment will be necessary. This treatment will include decontamination. Waste streams will undergo a segregation process to remove the elemental lead, Section 4.3.2. The resulting lead will be decontaminated as described in Section 4.3.4. Lead not amenable to decontamination, will be macroencapsulated, as described in Section 4.3.5. Upon achieving radiological release levels, the lead will be sent to the vendor for recycling.

5.3.2 Nickel Cadmium (Ni-Cd) Batteries

The FEMP has one drum of spent Ni-Cd batteries in storage. These batteries are classified as recyclable materials. A recycling program/vendor is not in place for the Ni-Cd batteries, however, a program similar to the lead acid battery program will be developed. Decontamination, monitoring, packaging, and handling procedures are expected to occur similar to the lead acid batteries procedure. Identification and selection of a qualified vendor must be performed.

5.3.3 Uranium Residues

There is a large population of uranium residues which exceed DOE's established EDL disqualifying the material for direct disposal per DOE orders. Uranium concentrations in these residues is high enough to disqualify the material as a waste. With proper treatment, (i.e., purification), the residue will produce an economic value. Even though these uranium residues will not follow the conventional recycle program flow, FEMP will recognize an equivalent benefit and volume reduction of waste for disposition. Additional information is provided for the recovery of uranium residues in Section 4.3.9.

6.0 ENVIRONMENTAL COMPLIANCE AND SPILL RESPONSE

The Chemical Treatment Project involves treating radioactive low level mixed wastes to meet RCRA LDRs and waste disposal facility WACs. Treatment will be accomplished employing a variety of treatment processes. In addition, the project will comply with all other applicable or relevant and appropriate requirements (ARAR) established under federal and state environmental regulations.

6.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)

Table 6-1 of this section identifies the ARARs for the Chemical Treatment Project. As part of Removal Action (RA) No. 9, treatment processes established under the Chemical Treatment Project will be exempt from the requirement to obtain administrative permit approval under Section 121(e) of CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as promulgated in 40 CFR 300.400(e).

Although on-site removal actions are exempt from the requirement to obtain administrative permit approval, Paragraph XIII.B of the Amended Consent Agreement requires DOE-FN to supply specific information regarding the permits that would have been required in absence of the CERCLA permitting exemption described above. To satisfy this Amended Consent Agreement requirement, the following three pieces of information have also been included in Table 6-1:

- Identification of permits that would be required in absence of the CERCLA Section 121(e) exemption.
- Identification of the standards, requirements, criteria, or limitations (ARARs) that would have to be met to obtain the permits.
- An explanation of how the response act will meet the standards, requirements, criteria, or limitations identified above.

Each treatment process included under the Chemical Treatment Project will be evaluated against these ARARs and substantive permitting requirements to determine its specific compliance requirements. ARAR tables documenting these requirements will then be included in the Technology Specific Work Plans prepared for each treatment process.

TABLE 6-1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)		
PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARAR)	COMPLIANCE PLAN
National Emission Standards for Hazardous Air Pollutants - (NESHAP) - 40 CFR Part 61, Subpart H - Emissions of Radionuclides Other Than Radon From DOE Facilities	40 CFR 61.92: Radiological emissions (except radon-222 and radon-220) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in an effective dose equivalent of 10 mrem in any one year. 40 CFR 61.07 and 61.96(b): An application for approval does not have to be filed for radionuclide sources if the effective dose equivalent caused by all emissions from the new construction or modification is less than 0.1 mrem per year. 40 CFR 61.93(b): Continuous emission monitoring is required for stacks and vents that have the potential, under normal operating conditions, but without emission control devices, to release radionuclides in sufficient quantities to cause any member of the general public to receive an effective dose equivalent of 0.1 mrem/year or greater.	Dose estimates for sub-projects included under the Chemical Treatment Project will be included in the annual FEMP NESHAP Subpart H report. Emissions from the project will not exceed the annual 10 mrem per year standard to off-site members of the general public. Evaluations will be conducted to determine if continuous emission monitoring will be required for stacks and vents associated with the project. Radionuclide emissions from the project are not expected to cause any member of the general public to receive an effective dose equivalent of 0.1 mrem/year or greater.
National Pollutant Discharge Elimination System (NPDES) Permit - OEPA NPDES Permit No. 1IO00004*DD (OAC 3745-33-05)	Waste water discharges must not cause a violation of effluent limitations or loading rates at NPDES permitted outfalls. Discharges must be conducted in accordance with applicable terms and conditions of the permit. These include compliance with the notification requirements promulgated in 40 CFR 122.42 and OEPA water quality standards established under OAC 3745-1.	Discharges associated with the Chemical Treatment Project will comply with the current FEMP NPDES permit. All excess water that is not consumed during treatment of wastes will be managed until characterization indicates the waste water can be discharged to the FEMP waste water treatment system.
Atomic Energy Act (10 CFR 835)	Radiation doses, levels, and concentrations in restricted and unrestricted areas.	Emissions from the Chemical Treatment Project will not result in the radiation limits being exceeded in restricted and unrestricted areas in accordance with the Project Specific Health and Safety Plan.

TABLE 6-1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)		
PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARAR)	COMPLIANCE PLAN
Air Pollution Control - Permits to Install & Permits to Operate (OAC 3745-31 and OAC 3745-35)	OAC 3745-31-05(A) Permits to Install: Installation of the proposed air contaminant sources must not prevent or interfere with the attainment or maintenance of applicable ambient air quality standards; and must not result in a violation of any applicable laws; and must employ the Best Available Technology (BAT) to control emissions. OAC 3745-35-01 (C) - Permits to Operate: Air contaminant sources must be operated in compliance with applicable air pollution control laws; must be constructed, located, or installed in compliance with the substantive requirements of the permit to install; and must not violate NESHAP standards adopted by the Administrator of USEPA.	Any air contaminant sources installed under the Chemical Treatment Project will not interfere with the attainment of any applicable air quality standards or cause a violation of any applicable laws. BAT will be implemented in the form of HEPA filtration to control radiological particulate emissions. BAT requirements for toxic air pollutants will be determined for each treatment process on a case-by-case basis in accordance with OEPA's Air Toxic Policy. Process equipment will be operated in compliance with applicable air pollution control laws and will not violate applicable NESHAP Standards.
Safe Drinking Water Act (42 U.S.C. 300G; PL 93-523)	National Primary Drinking Water Regulations (40 CFR 141). National Revised Primary Drinking Water Regulations (40 CFR 141.60 through 141.63) Ohio Primary Drinking Water Regulations (OAC 3745-81)	Compliance will be demonstrated by site-wide environmental monitoring, including air, soil, and groundwater. Reports summarizing the site-wide monitoring results will be submitted to EPA. Surface water discharges will be conducted in accordance with the site NPDES permit and are not expected to impact groundwater quality. Engineering controls and best management practices will be used to mitigate the potential discharge of contaminated waste water to the underlying aquifer. The FEMP will ensure groundwater is not adversely impacted through continued monitoring under its existing Groundwater Monitoring Program.

TABLE 6-1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)		
PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARAR)	COMPLIANCE PLAN
Radiation Exposure to the Public	Radiation Dose Limit (40 CFR 192.02(b)) Radiation Dose Limit (Drinking Water Pathway) (10 CFR 834)	The project will be designed and operated to minimize the releases of radionuclides. Compliance will be demonstrated by site-wide environmental monitoring, including air, soil, and groundwater. Reports summarizing the site-wide monitoring results will be submitted to the EPA.
Resource Conservation and Recovery Act (U.S.C. 6901 et. seq.)	Hazardous Waste Determinations (OAC 3745-52-11) (40 CFR 262.11)	Project wastes will be characterized to determine their corresponding EPA waste codes and appropriate LDR treatment standards. Wastes generated from the project will be characterized in accordance with site procedure EW-0001 and the FEMP Waste Analysis Plan.
	Interim Status: Treatment, Storage, and Disposal General Facility Standards (OAC 3745-65-13 through 16) (40 CFR 265.13 through 265.16)	The Chemical Treatment Project will be conducted in accordance with RCRA regulations. Existing site security measures will be utilized. Inspections will be conducted in accordance with RCRA regulations and existing site procedures. Personnel will be trained in accordance with FEMP requirements.
	Interim Status: Treatment, Storage, and Disposal Facility Preparedness and Prevention (OAC 3745-65-31 through 35, 3745-65-37) (40 CFR 265.31 through 265.35, 265.37)	Preparedness and prevention equipment, as specified in regulations, will be on-site, available, and in operating condition throughout the duration of the project. The existing FEMP site-wide internal communications/alarm systems will be used. Portable fire extinguishers and spill control equipment will be placed in accessible locations to assist in emergency response. Warning signs will be posted at the entrance to each process area. Containers and equipment will be inspected daily in accordance with existing site procedures.
	Interim Status: Treatment, Storage and Disposal Facility Contingency Plan and Emergency Procedures (OAC 3745-65-51 through 56) (40 CFR 265.51 through 265.56)	The existing RCRA FEMP Contingency Plan and Emergency Procedures will be followed for any hazardous waste emergency associated with the project.
	Container Storage (OAC 3745-52-34, 3745-66-70 through 77) (40 CFR 262.34, 265.170 through 265.177)	Containers of hazardous waste will be managed and inspected in accordance with regulatory requirements. Secondary containment will be provided for the tanks and drumming stations. Containers will be handled in a manner to prevent rupture, leakage, or spillage. Containers will be compatible with the material being stored and will remain closed during storage.
	Residue of Hazardous Waste in Empty Containers (OAC 3745-51-07) (40 CFR 261.7)	Containers used for the Chemical Treatment Project will be considered empty in accordance with the requirements of this rule.

TABLE 6-1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)		
PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARAR)	COMPLIANCE PLAN
Resource Conservation and Recovery Act (U.S.C. 6901 et. seq.)	Land Disposal Restrictions (OAC 3745-59) (40 CFR 268)0	Waste will be treated to meet the appropriate LDR treatment standards. A treatability variance may be required for certain types of waste.
	CERCLA Off-site (40 CFR Part 300)	All material removed from the FEMP will be managed in compliance with applicable provisions of RCRA and other Federal and State requirements including EPA's off-site rule and Waste Analysis Plan.
	Reusable Equipment Decontamination (OEPA Closure Plan Review Guidance for RCRA Facilities)	Decontamination of reusable equipment is discussed in Section 4.10 of this Work Plan. Reusable equipment contacting waste will be triple rinsed in accordance with OEPA Closure Plan Review Guidance.
	Preparing and Transporting Hazardous Waste Off-site (OAC 3745-53-20 through 31) (OAC 3745-52-3 and 33) (40 CFR 262.20 through 262.33 and 40 CFR 263.20)	Any generator who transports hazardous waste for off-site treatment, storage, or disposal must originate and follow-up the manifest for off-site shipments. Pre-transporting requirements include appropriate packaging, labeling, marking, and placarding. Any project waste residues determined to be RCRA hazardous waste that are destined for off-site disposal will be subject to manifest requirements.
	Air Emissions Standards for Process Vents (40 CFR 265.1032 through 265.1034)	Activities regulated under these standards will comply with the substantive requirements of Sub-part AA.
	Air Emissions Standards for Equipment Leaks (40 CFR 265.1052 through 265.1063)	Leak detection monitoring and repair of equipment components regulated under these standards will be conducted in accordance with the substantive requirements of Sub-part BB.
PCB Treatment Requirements (40CFR 761.60(e)	Any person who is required to incinerate any PCBs and PCB items under this Subpart may demonstrate that an alternative method of destroying PCBs and PCB items exists; provided that this alternative method can achieve a level of performance equivalent to 40 CFR 761.70 incinerators or high efficiency boilers.	This requirement is applicable only if PCB contaminated items (cloth, debris) or soil exhibiting a concentration greater than 50 ppm are treated on property using a method besides incineration.
Occupational Worker Protection & Training (29 CFR 1904 & 1910)	All facility personnel will be trained. Employers will develop and implement a written safety and health program for employees involved in hazardous waste operations.	The Chemical Treatment Project will be conducted in accordance with the requirements of the Project Specific Health and Safety Plan.

TABLE 6-1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR)		
PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARAR)	COMPLIANCE PLAN
DOT Requirements for Transportation of Hazardous Materials 49 CFR 171-173 and 49 CRF 177-179	No one may transport hazardous materials on public highways except in accordance with these regulations.	Off-site shipment of hazardous wastes will be conducted in accordance with these requirements. Shipping papers, marking, labeling, placarding, and emergency response information will be prepared for off-site shipments.
National Environmental Policy Act (NEPA) (10 CFR 1021)	Ensure that all federal agencies (including DOE) consider environmental impacts in the planning and decision-making phases of their projects.	On June 13, 1994 the DOE issued a revised policy statement on NEPA. The new policy allows DOE to rely on the CERCLA process to satisfy the procedural aspects of NEPA. To achieve the goals of this policy, NEPA values will be incorporated in the project through the CERCLA process.
DOE Orders0.00	To be considered.	All project design activities shall be implemented according to existing site procedures.

Representatives from the FEMP will conduct inspections during performance of this response action to ensure operations are conducted consistent with discussions in technology specific work plans. Inspections will ensure equipment associated with the project is properly cleaned and decontaminated and wastes resulting from the project are properly stored, labeled, and characterized.

7.0 HEALTH AND SAFETY

A Health and Safety Plan will not be developed to accompany the Chemical Treatment Project General CERCLA Work Plan. Project Specific Health and Safety Plans (PSHSP) will be developed for each chemical treatment process. The PSHSP will cover the hazards associated with the waste being treated and the hazards of the treatment process.

All work conducted on the FEMP site will comply with the requirements in the documents listed in Table 7-1. Personnel involved with the various chemical treatment processes will receive training on the documents as required.

TABLE 7-1
SITE PLANS, MANUALS, AND STANDARD OPERATING PROCEDURES

NUMERICAL DESIGNATION	TITLE
PL-3020	FMPC Emergency Plan
None Assigned	FEMP RCRA Contingency Plan
RM-0021	Safety Performance Requirements Manual
PL-2194	FMPC Spill Prevention Control & Countermeasure Plan
RM-0007	FMPC Respiratory Protection Program
RM-0012	FERMCO Quality Assurance Program Plan
FMPC-0516	Control of Permits for Accomplishing Hazardous Work
PT-0001	The On-Site Transportation of Radioactive and Nonradioactive Hazardous Materials
RM-0005	FEMP Lot Marking and Color Coding System
EP-0004	Personnel Accountability
EW-0002	Spill Incident Reporting and Cleanup
SSOP-0018	Processing The Site Wide Analysis Request/Custody Record for Sample Control
SOP 20-C-606	Hazardous Waste Spill Cleanup
EQP-12.06	Certification of Hazardous Waste Loading, Examination of Transport Vehicle/Trailer for Off-Site Shipment
SOP 20-C-017	Movement of Hazardous Waste
SOP 20-C-630	Storage of Hazardous Waste
EW-0001	Initiating Waste Characterization Activities Using the Material Evaluation Form (MEF)
EM-2-013	Environmental On-Site Media Sampling
SP-P-35-028	Inspection and Performance Testing of Portable Radiation Survey Instruments
PT-0008	Packaging, On-Site Movement and Off-Site Shipment of Material

8.0 PROJECT MANAGEMENT

8.1 ORGANIZATION

An organizational structure will be established for oversight of each treatment process. The structure will be developed to assure all functional areas are covered and will operate as a unit under the leadership and direction of the project manager. Functional areas will include overall project management and management support, operations management, health and safety, and quality assurance.

An organizational structure will be developed to outline the interface between the FEMP and the selected vendor when a treatment process has been subcontracted.

8.2 WORK BREAKDOWN STRUCTURE

The general Project Work Breakdown Structure is shown in Figure 8-1. At the first level of the breakdown, it reflects the main elements of a treatment process. In the first element, the ultimate product is a set of approved job plans, specifications, and procedures. In the second phase, treatment operations are performed.

8.3 LOGIC DIAGRAMS

The general progression of work activities for each treatment process and their interrelationship are shown on the logic diagrams in Figure 8-2. The logic illustrated provides the basis for project schedules and resource needs for accomplishing the job as required.

8.4 DATA CONTROL

Data control specifies requirements for control of accuracy, precision, and completeness of data. Data control is exercised from sample collection, through laboratory analysis, and transmittal and validation of generated data. Data quality objectives (DQOs) represent a formal decision process which establishes the level of uncertainty acceptable in analytical results derived from process data. The DQO process must balance time, cost, and data quality, and be initiated during project planning stages in order to prepare work plans that have a quantifiable degree of uncertainty. Criteria for DQOs are the end use of data to be collected. DQOs will be specified in the SAP prepared for each treatment process.

DQOs are used to determine data reliability needed for a project, and the analytical support levels (ASLs) required to provide that data reliability. The ASLs apply to all of the techniques and methods that contribute to the generation of analytical data. ASLs A through E are described in DOE-FN/EPA 200 Report, Site-wide CERCLA *Quality Assurance Project Plan (SCQ),* Volume I. The choice of levels is based on the waste to be investigated, the level of accuracy and precision required, and the intended use of the data. Table 8-1 outlines the ASLs.

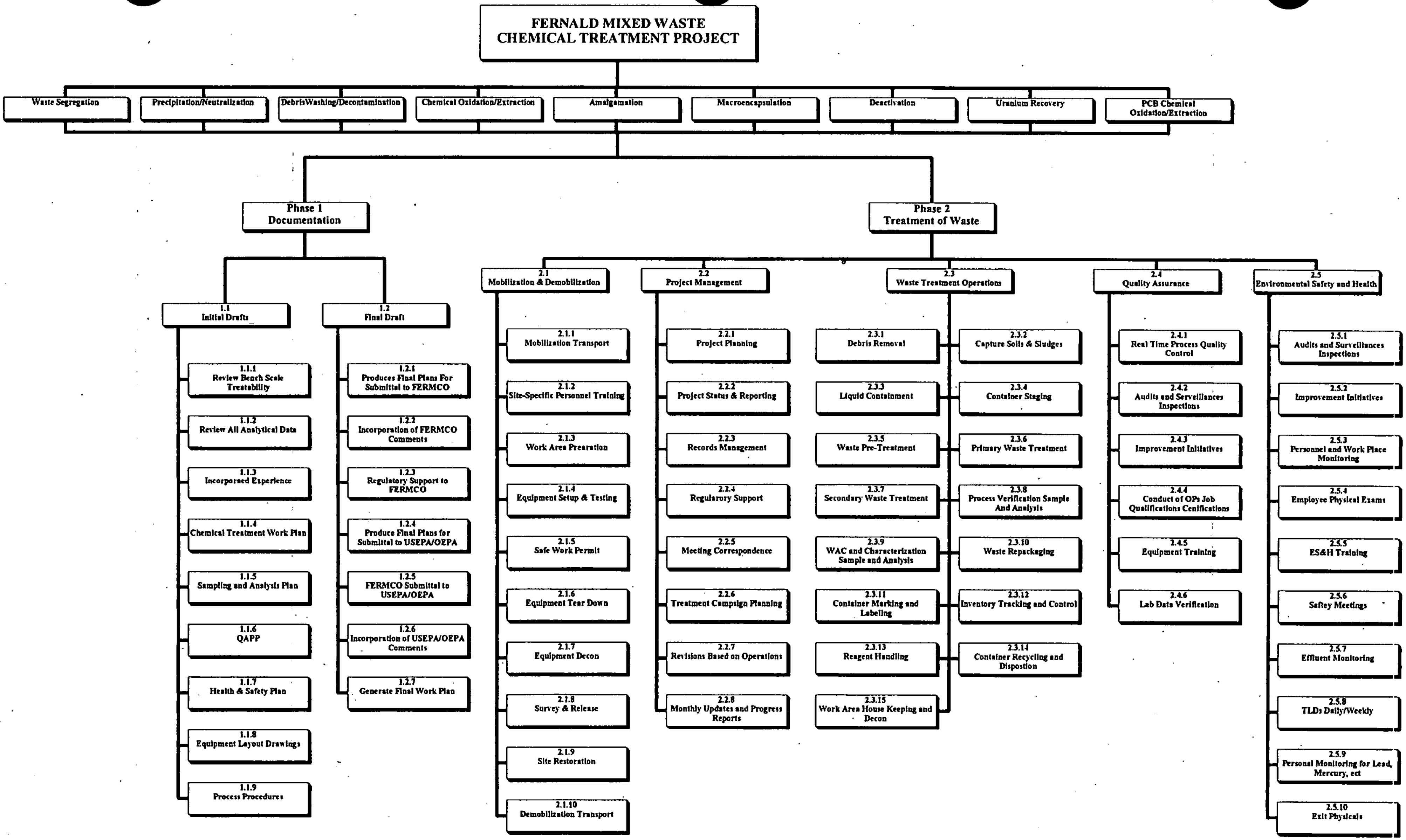

Figure 8-1
Project Work Breakdown Structure
Mixed Waste Chemical Treatment Project

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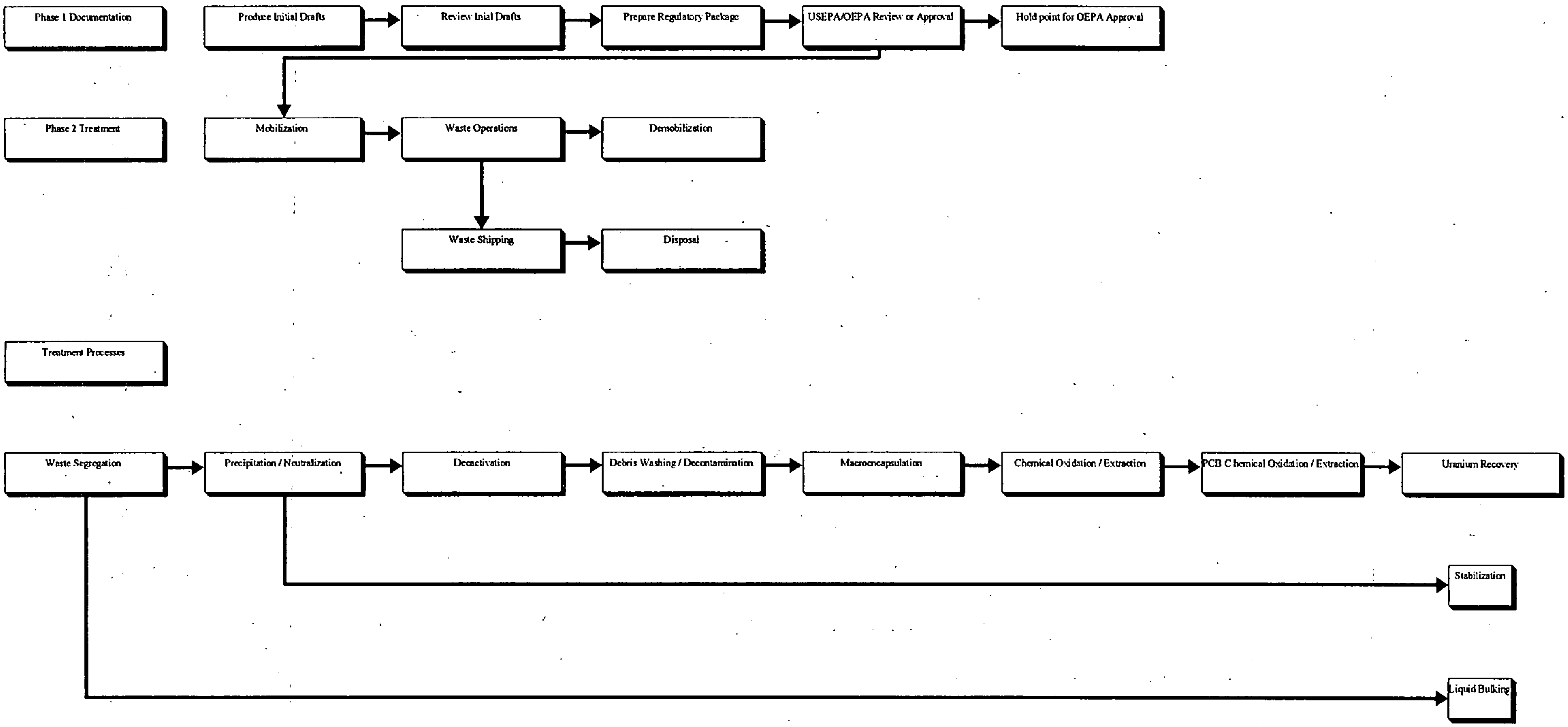

Figure 8-2
Logic Diagram

Chemical Treatment Project

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TABLE 8-1 SCQ QC LEVELS	
ANALYTICAL SUPPORT LEVEL (ASL)	EXAMPLES OF DATA USES
A Qualitative Field Analysis	Preliminary site characterization Real-time monitoring of implementation Field screening
B Qualitative, Semi-Quantitative, and Quantitative Analyses (Sublevel 1 or 2)	Site characterization Evaluation of alternatives Engineering design Real-time monitoring of implementation Field screening
C Quantitative with Fully Defined QA/QC	Risk assessment Site characterization Evaluation of alternatives Engineering design Real-time monitoring of implementation
D Conformational with Complete QA/QC and Reporting	Risk assessment Vertical & horizontal extent Evaluation of alternatives Engineering design Evaluation of remediation results
E Non-Standard	Risk assessment Evaluation of alternatives Engineering design Vertical & horizontal extent Evaluation of remediation results

8.4.1 Data Quality Control Levels

Three ASLs will probably be adopted for each treatment process in accordance with the SCQ. ASLs will be reviewed and assessed for each treatment process. Real-time testing will likely be performed at ASL A. This will include in-line process testing and monitoring units. Additional testing may be utilized for screen testing treated wastes. The analytical data generated from process feedback sampling and analysis activities will likely conform to ASL level B (sublevel 1). The laboratory data produced for proof of LDR treatment standard compliance and disposal facility waste acceptance criteria will likely need to conform to ASL C. Field and laboratory QC standards will be complied with to assure that field and laboratory activities are consistent with the specified ASL.

8.4.2 Project Documentation and Data

Project documentation will be maintained in dual storage per the requirements of NQA-1. This documentation will include contractual records, official correspondence, operations logs, waste logs, sampling and analysis logs, inspections, surveillances and calibration records, self assessments, audits, and record of FEMP product acceptance.

8.5 SAMPLE CONTROL

Sampling and analysis will be performed in accordance with the *Sampling and Analysis Plan* (SAP) developed for each treatment process. The SAP will define samples taken for several different purposes and may include the following:

- Proof of LDR Treatment Standard Compliance and Disposal Facility Waste Acceptance Criteria (WAC)
- Process Feedback Analysis and Control
- Project Archives

During waste treatment operations, waste will be sampled for WAC and process feedback purposes. The samples will be labeled and marked, and identification numbers recorded with corresponding sampling and analysis procedures. Chain-of-Custody procedures will be maintained at all times. Additional information is provided in Section 9.0 of this work plan.

8.6 QUALITY ASSURANCE

The following Quality Assurance Program Criterion will be incorporated, as required, in the development of each treatment process, as described by FEMP Quality Assurance Program Description (RM-0012).

8.6.1 Criterion 1 - Program

This criterion describes requirements for an organization to develop and maintain an effective management system. The management system shall include methods of managing, performing, and assessing adequacy of work, including work assigned to parties outside the organization.

The Chemical Treatment Project shall describe on-site and off-site organizational elements, including interfaces for roles and responsibilities of FERMCO and DOE Fernald Field Office (DOE-FN) in the review of contractor's QA Plans. Positions, rather than individuals, are to be listed.

Environmental sampling and analysis (SA) shall comply with quality assurance and quality control requirements specified in FD-1000, Sitewide CERCLA Quality Assurance Project Plan (SCQ), as approved by the DOE and the EPA, as well as with this QAP.

The quality of items and processes are ensured to an extent consistent with their potential impact on safe and reliable operation of the project. A graded approach, as specified in Appendix D of RM-0012 - Graded Approach for Quality Levels, shall be used to ensure resources applied are commensurate with the importance of the result to the achievement of site goals.

Readiness reviews shall be performed prior to initiation of major work activities identified to require readiness review. These readiness reviews will verify the following:

- Work prerequisites are satisfied, including regulatory compliance issues.
- Detailed technical and QA procedures have been reviewed for adequacy and appropriateness.
- Training programs are in place.
- Personnel are suitably trained and qualified.
- Proper equipment, material, and resources are available.

The Project Manager (P.M.) shall identify the responsibility and authority to stop unsatisfactory work and control further processing, delivery, installation, or use of nonconforming items such that planning and schedule considerations do not override safety, quality, or environmental considerations. A readiness review using a graded approach shall be performed prior to restarting work affected by a stop work order.

8.6.2 Criterion 2 - Personnel Training and Qualification

This criterion describes project requirements for personnel to be trained and qualified to ensure they are capable of performing their assigned work. Personnel shall be provided continued training to ensure that job proficiency is maintained.

All personnel shall be capable of performing their assigned tasks. Training plans shall be developed for all personnel. Training identified in the plans shall prepare the employee to perform the job, as well as, maintain and promote progressive improvement and employee satisfaction. Qualification requirements (experience, education, and training) shall be documented for each position as required.

8.6.3 Criterion 3 - Quality Improvement

This criterion describes the requirements for establishing and implementing processes to detect, control, correct, and prevent quality problems and to promote quality improvement.

8.6.4 Criterion 4 - Documents and Records

This criterion describes the requirements for establishing and implementing a system for the control of documents and the handling, collection, storage, and control of records generated at the project.

A system shall be established and implemented to control preparation, review, approval, issuance, use, and revision of documents that establish policies, prescribe work, specify requirements, or establish design. The scope of the document control system shall be defined.

Revisions to controlled documents shall be reviewed and approved by the organization that originally reviewed and approved them. An alternative organization may be designated based on technical competence and capability.

8.6.5 Criterion 5 - Work Processes

This criterion describes the requirements for the control of processes affecting all work processes of this project. A work process includes all activities involved in performing defined tasks to achieve an objective. Work processes may include activities as planning, scheduling, accounting, project management, design, analysis, fabrication, procurement, construction, installation, testing, operation, modification, maintenance, and decommissioning.

The purpose of work process control is to ensure that standard processes and special processes are accomplished under controlled conditions. These standard processes and special processes include, but are not limited to: waste handling, packaging, certification and shipping; environmental data operations; welding; heat treating; core drilling; or nondestructive testing.

Items shall be identified and controlled to ensure their proper use. Items shall be maintained to prevent their damage, loss, and deterioration. Equipment used for process monitoring or data collection shall be calibrated and maintained.

Work related instructions, procedures, and other forms of direction shall be developed, verified, validated and approved by technically competent personnel, and shall be provided to employees doing the work.

Work shall be performed to established technical standards and administrative controls. Work shall be planned, authorized and accomplished under controlled conditions using technical standards, instructions, procedures, or other appropriate means of detail commensurate with the complexity and importance of the work.

Low-level waste shipments to the Nevada Test Site shall meet the requirements of NVO-325, Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements.

8.6.6 Criterion 6 - Design

This criterion describes the requirements for the implementation of a design control process. Design work is based on sound engineering/scientific principles and appropriate standards. The requirements of this criterion apply to all organizations that perform design or are responsible for design performed by contractors or subcontractors.

The Chemical Treatment Project shall establish and implement a program for the design of items and processes using sound engineering/scientific principles and appropriate standards.

A design process shall be established which provides control of design inputs, outputs, verification, configuration and design changes, documentation, records, and technical administrative interfaces.

The administrative interface process shall clearly indicate responsibilities for design output document activities including as-built mark-up and updating during project construction/production phases, media use and transmission, document control, and records management..

Changes to final designs (including nonconforming items that are dispositioned "use as is" or "repair") are to be subjected to design control measures commensurate with those applied to the original design and approved by the organization that approved the original design or a qualified designate. Temporary modifications shall receive the same levels of control as the designs of permanent modifications.

The acceptability of design activities and documents, including design inputs, processes, outputs, and changes, are to be verified. Design verification is a formal documented process to establish that the resulting Systems, Structures, and Components will be fit for the intended use.

Computer programs are to be proven through previous use, or verified through testing or simulation prior to use. When a test program is used to verify the acceptability of a specific design feature, the test program is to demonstrate acceptable performance under conditions that simulate the most adverse design conditions that are expected to be encountered. Changes to computer software shall be controlled to assess the potential impact of the change on the performance of the software.

8.6.7 Criterion 7 - Procurement

This criterion describes the requirements for the preparation, review, and control of procurement documents. It also specifies the requirements and responsibilities for the control of purchased material, equipment, and services.

A program shall be established and implemented to ensure that purchased items and services meet established requirements and perform as expected.

The applicable requirements of 10 CFR Part 830.120 Nuclear Safety Management, RM-0012, and of this Quality Assurance Plan shall be applied to suppliers and subcontractors who perform work under the prime cognizance of FERMCO or work that affects the responsibility of FERMCO.

Applicable technical and administrative requirements (such as specifications, codes, standards, tests and inspections, and acceptance criteria) shall be invoked for procurement of items and services.

Procurement documents shall include any specifications, standards, and other documents referred to by the design documents. Procurement documents shall clearly state test/inspection requirements and acceptance criteria for purchased items and services.

Critical parameters and requirements such as submittals, product-related documentation, nonconformance requirements, administrative documentation, personnel or materials qualification, tests, inspections, and reviews shall be specified as line items.

Prospective suppliers are to be evaluated to ensure that only qualified suppliers are selected. The prospective suppliers shall be evaluated to verify their capabilities to meet performance and schedule requirements.

Measures for evaluating and selecting suppliers may include:

- a review of the supplier's history for providing identical or similar items or services;
- an assessment of the supplier's capability based on evaluation of its facilities, personnel, and programs; or
- an evaluation of documented qualitative and quantitative information provided by the supplier.

Procurement of laboratory subcontractors for analyzing environmental samples shall be strictly controlled. Only laboratories that have a demonstrated capability to provide the level of data quality required for a program or project shall be contracted.

8.6.8 Criterion 8 - Inspection and Acceptance Testing

This criterion describes requirements for performing inspection and acceptance testing. Inspection and acceptance testing of specified items and processes shall use established acceptance and performance criteria and require calibration and maintenance of equipment used for inspections and tests.

Inspections and tests shall be conducted according to a graded approach. Results of these activities shall be documented and retained as project records.

A program shall be established and implemented to specify when and what type of inspections (e.g., source, in-process, final receipt, maintenance, and in-service) are required.

Administrative controls and status indicators are to be used to preclude inadvertent bypassing of required inspections and to prevent inadvertent operation of the item.

When appropriate, inspection hold points shall be defined beyond which work is not to proceed until inspection has been completed.

Inspection/test results shall be evaluated and verified by authorized personnel to document that all requirements have been satisfied.

A test control program shall be established as required and implemented for acceptance testing to demonstrate that items will perform as intended. The test control program is to include, as appropriate, bench tests and proof tests before installation, pre-operational tests, post-maintenance tests, post-modification tests, and operational tests all based on a graded approach.

The criteria that specifies when testing is required shall be defined. Administrative controls and status indicators, such as tags and labels, are to be used to preclude inadvertent bypassing of required tests and to prevent inadvertent operation of the item.

A program shall be established and implemented to control the calibration, maintenance, accountability, and use of equipment used for acceptance of items during inspection and testing.

8.6.9 Criterion 9 - Management Assessment

This criterion describes the requirements for regularly assessing and documenting the adequacy and effectiveness of the QA program in providing the framework for FERMCO's achieving its mission and objectives.

Management at all levels are required to periodically assess the integrated QA Program and its performance, and to identify and correct problems that hinder the organization from achieving its quality objectives.

These management assessments should focus on whether the integrated QA management system is accomplishing the goal of continuous improvement of the safety and reliability of products and services to effectively meet the expectations of external and internal customers.

A program of planned and periodic management assessments shall be established and implemented. Implementation of the program is to focus on how well the integrated QA Program is working by identifying barriers which hinder the organization from achieving its objectives in accordance with quality, safety, and environmental requirements.

8.6.10 Criterion 10 - Independent Assessment

This criterion describes the requirements for the implementation of an independent assessment program. The FERMCO independent assessment program evaluates the adequacy and effectiveness of activities for compliance with applicable requirements.

The independent assessment process should use a performance-based approach with emphasis on results and with compliance viewed as the baseline. Assessments should be conducted on activities that most directly relate to final objectives and should emphasize safety, reliability, and product performance. Independent assessments may include such methods as inspections, peer and technical reviews, audits, surveillances, or combinations thereof.

Independent assessments shall be conducted using criteria that address environmental, safety and health, and remediation requirements. The assessments shall also describe acceptable work performance and promote improvement. They shall include an evaluation to determine whether technical requirements, not just procedural compliance, are being met.

Scheduling of assessments and allocation of resources shall be based on status, risk, and complexity of the item or process being assessed. Scheduling shall be flexible and additional attention shall be given to areas of questionable performance.

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9.0 SAMPLING AND ANALYSIS (S&A) REQUIREMENTS

Wastes in the Chemical Treatment Project will require re-characterization upon completion of processing. Whenever wastes are sampled and analyzed, a Sampling and Analysis Plan (SAP) must be prepared. The SAP will describe sampling and analysis (S&A) procedures utilized in determining chemical and radiological components and concentrations of the waste, whether the waste meets LDRs, to verify treatment effectiveness, and to satisfy disposal facility waste acceptance criteria (WAC).

All sampling and analysis activities will comply with 40 CFR 261 through 268 as well as satisfy DOE Order 5820.2A. The Chemical Treatment Project sampling and analysis will include the following requirements:

9.1 CHARACTERIZATION

Characterization sampling and analysis will be performed on each waste upon completion of the treatment process for performing characterization and determining LDRs have been met. Samples representative of the waste inventory will be taken, Quality Control (QC) will be implemented to document the quality of analytical results, and appropriate analytical procedures will be used to properly characterize the treated waste. The number of samples taken and analytical methods employed will conform with SW-846 guidelines.

Characterization sampling and analysis should satisfy NTS WAC sampling and analysis requirements. Additional sampling and analysis may be required to satisfy the mixed waste disposal facility WAC.

9.2 PROCESS VERIFICATION

Sampling and analysis will be performed during each treatment process. This sampling and analysis will be an in-field screening activity providing results to Chemical Treatment Project technical personnel for verifying the effectiveness of treatment.

A Process Control Plan (PCP) will be generated for each treatment process. The PCP will specify analyses, number, quantity and frequency of samples, parameters, and methods for conducting process verification sampling and analysis. The only treatment process which will not require verification analysis is Waste Segregation.

9.3 DISPOSAL FACILITY WASTE ACCEPTANCE CRITERIA (WAC)

The primary objective of WAC sampling and analysis is to determine if a waste complies with disposal facility WAC. Additional concerns addressed include:

1) Analytical requirements (e.g., RCRA thresholds for the Toxicity Characteristic, LDR treatment levels, PCB levels, etc.)

2) Number of containers to be sampled, which containers require sampling

3) Which laboratory(ies) perform which analysis? Laboratory selection criteria

4) QA levels/requirements, and data quality objectives (DQO)

Waste acceptance criteria for each disposal facility is unique and must be considered when developing a SAP. In some occasions characterization sampling and analysis will satisfy disposal facility WAC. Additional WAC sampling and analysis requirements will be included in the SAP. Sampling and analysis will not be necessary for the Waste Segregation process.

10.0 REFERENCES

Amended Consent Agreement Between DOE and U. S. EPA - 1991

ANSI/ANS-40.37-1993, Mobile Radioactive Waste Processing System

ANSI Standard 288.2-1980, *American National Standards Practices for Respiratory Protection*

ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, 1989 Edition

Comprehensive Environmental Response, Compensation, and Liabilities Act

10 CFR 830.120, *Quality Assurance*

29 CFR 1910.120(b), *Hazardous Waste Operations and Emergency Response*: Interim Final Rule, Department of Labor

40 CFR 264, Waste Management Requirements

40 CFR 355, Emergency Notifications

DOE Order 5400.5, *Radiation Protection of The Public and the Environment*

DOE Order 5700.67 C, *Quality Assurance*

Emergency Planning and Community Right-To-Know Act (EPCRA)

EPA Manual, "Test Methods for Evaluating Solid Waste" (SW-846)

EPA QAMS - 005/80

Federal Facility Compliance Agreement - Agreement Between DOE, U. S. EPA, and Ohio EPA

51 Federal Register 45654, December 19, 1986

FERMCO *Quality Assurance Program* (RM-0012)

National Institute of Occupational Safety and Health Publication No. 84114, *Personal Protective Equipment for Hazardous Materials*

Nevada Test Site - *Defense Waste Acceptance Criteria, Certification, and Transfer Requirements* (NVO-325, Rev. 1)

Occupational Safety and Health Administration Regulations

Ohio Administrative Code (OAC) Chapters 3745-49 through 3745-69

Superfund Amendments and Reauthorization Act - 1986

U. S. EPA Best Demonstrated Available Technology/Resource Conservation and Recovery Act

U. S. EPA, *Quality Objectives for Remedial Response Activities Development Process*, OSWER Directive 9355.0-7B, March 1987

U. S. EPA Toxicity Characteristic Leaching Procedure (TCLP)